FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

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Founder and Editor: STANLEY SPOONER

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## CONTENTS



### DIARY OF CURRENT AND FORTHCOMING EVENTS

*Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in this list:—*

1931

- **Oct. 30.** Northamptonshire Ae.C. Annual Ball, Northampton.
- **Oct. 31.** Rugby. Combined Services *v.* Bristol, at Bristol.
- **Nov. 5.** "Safety in Spinning," Lecture by H. B. Irving before R.Ae.S.
- **Nov. 9.** "Aeroplane as an Aid to Mineral Exploration," Lecture and Film Show by J. McDonough at Gaumont Theatre, Wardour Street, W.
- **Nov. 18.** "Flying Boats in Empire Defence," Lecture by Wing-Com. R. M. Bayley, before R.U.S.I.
- **Nov. 19.** "Aircraft Vibration," Lecture by H. Constant before R.Ae.S.
- **Nov. 26.** Guild of Air Pilots and Air Navigators' Annual General Meeting.
- **Dec. 3.** "Wheel Brakes and Undercarriages," Lecture by S. Scott Hall before R.Ae.S.
- **Dec. 10.** "Air Flow—Demonstrations on the Screen by Means of Smoke," Lecture by W. S. Farren before R.Ae.S.
- **Dec. 17.** "Control Beyond the Stall," Lecture by Dr. G. V. Lachmann before R.Ae.S.

1932

- **Jan. 14.** "Interference," Lecture by E. Ower before R.Ae.S.
- **Jan. 28.** "Effect of Height on Range," Lecture by A. E. Woodward-Nutt and Flt.-Lt. A. F. C. Scroggs before R.Ae.S.
- **Feb. 24.** "A Flight to Abyssinia," Lecture by Sqdn.-Ldr. J. L. Vachell, before R.U.S.I.
- **Mar. 10.** "Results with the New Wind Tunnel at N.P.L.," Lecture by E. F. Relf before R.Ae.S.
- **Mar. 16.** "Development of Naval Air Work," Lecture by Commodore N. F. Laurence, before R.U.S.I.
- **Mar. 23.** "High-Speed Flying," Lecture by Sqd.-Ldr. A. H. Orlebar, before R.U.S.I.
- **Apl. 13.** "The North-West Frontier of India," Lecture by Maj.-Gen. S. F. Muspratt, before R.U.S.I.

# EDITORIAL COMMENT

**Imperial Airways**

THERE is nothing very surprising in the announcement that the earnings of Imperial Airways, Limited, were less in 1930-31 than in the previous year, and we can see no reason for pessimism in that fact. Very few firms in any country have escaped all effects of the general world depression, and what are called luxury trades were apt to suffer more severely than others. We very much regret having to suggest that air transport is luxury business, but we are afraid that at the present stage of development the expression is not entirely inappropriate. It offers greater speed, and, over certain sections of its airways, greater comfort than can be found in surface transport. Before very long, we feel certain, the speed of the aeroplane will be considered a necessity for mail carriage and for a first-class passenger transport, but at present it is not regarded as a necessity. It is, as a matter of fact, largely due to the steady work of Imperial Airways that air transport is being gradually raised from the class of luxury transport to that of standard transport. In the meantime, air transport is only too liable to suffer when luxury businesses generally report decreased earnings. We do, however, note with great satisfaction that the mail traffic on the Indian service increased most strikingly in this rather bad year. In 1929-30 45½ tons of mail (about 3½ million letters) were carried by Imperial Airways on this service. In 1930-31 the bulk had increased to 53¾ tons, which means about 4¼ million letters. Passenger traffic will, we believe, follow the mails.

What appears to be the most disturbing feature in the position of Imperial Airways, as presented by the speech of the chairman, Sir Eric Geddes, at the general meeting held on October 15, is the international situation. There was at one time a disagreement with Italy about the use of Italian ports by the flying boats of Imperial Airways. Happily this has now been overcome, and Genoa is once again the port from which the flying boats start. There remains, in the words of Sir Eric Geddes, "a blot on the political landscape of the Indian route." The present concession for operating through Persia

expires next April. The chairman hoped that the Persian Government would recognise the international importance of the air service and its value to Persia. Should they decide otherwise, the company had an alternative which could be put into operation with the full backing of the British Government, though with less convenience to the company. Sir Eric did not specify what this alternative is, but the obvious deduction is that the route would follow the Arabian, instead of the Persian, shore of the Persian Gulf.

This route would certainly be less convenient. It follows the outside of a semi-circle instead of the inside. That implies greater mileage, especially if landplanes are used as at present. We have no precise knowledge of the local conditions, and cannot say if the coast is suitable for the operations of flying boats. Its general characteristics, as shown on a map, are exactly the opposite of those on the Persian coast. Along the Persian coast the mountains come close down to the sea along most of the route. The Arabian shore is all flat and low-lying. Bays and apparently sheltered waters are more numerous on the Arabian than on the Persian side. There is one very large bay to the south of a line drawn between Ras Rakan and the promontory which runs up into the straits of Ormuz, and the distance between those two points is some 300 miles of open water. Modern flying boats could make it if the harbours at both ends are suitable. Landplanes, following the coast, would have to make a detour of many miles. Part of the coast along this stretch bears the ominous name of Pirate Coast. There is no doubt that this alternate route would not be so convenient for Imperial Airways.

We can, however, easily understand that the use of the Arabian coast would have the full backing of the British Government. It is not satisfactory that our airways should be dependent for continuity of service on the goodwill of a foreign Power. In Europe it appears unavoidable that they should be so dependent. At the moment we have not got the aircraft which could operate on an all-red route. We are not continuing experiments with airships. One flying boat, the Saro A.7, has made a non-stop flight from Gibraltar to England, which does not mean that we are yet able to make that flight regularly with a commercial boat. We must hope that the goodwill of the Continental nations will continue to allow us to fly across their territory. If that goodwill were to cease, presumably our air service to India would also cease, and we should be left lamenting that we had not persevered with airships.

Wherever possible, therefore, it should be our policy to lay out our airways along routes where the continuity of the service does not depend on the goodwill of foreign nations. That should be a principle based on the ability to maintain a commercial service. There is, however, another reason for aiming at such routes, namely, the possibility of the routes being used by the Royal Air Force in an emergency. The directors of Imperial Airways are not primarily concerned with that possibility. Their chief concern, as Sir Eric Geddes pointed out, is to use every endeavour to find ways and means to make their undertaking a self-supporting commercial undertaking at the earliest possible moment. It would be against the spirit of their agreement with the Government to use their subsidy to lay out routes for the benefit of the Royal Air Force if those routes were not the most suitable for themselves. But when the two interests lie in the same direction, the taxpayer may congratulate himself that two birds are being killed with one stone.

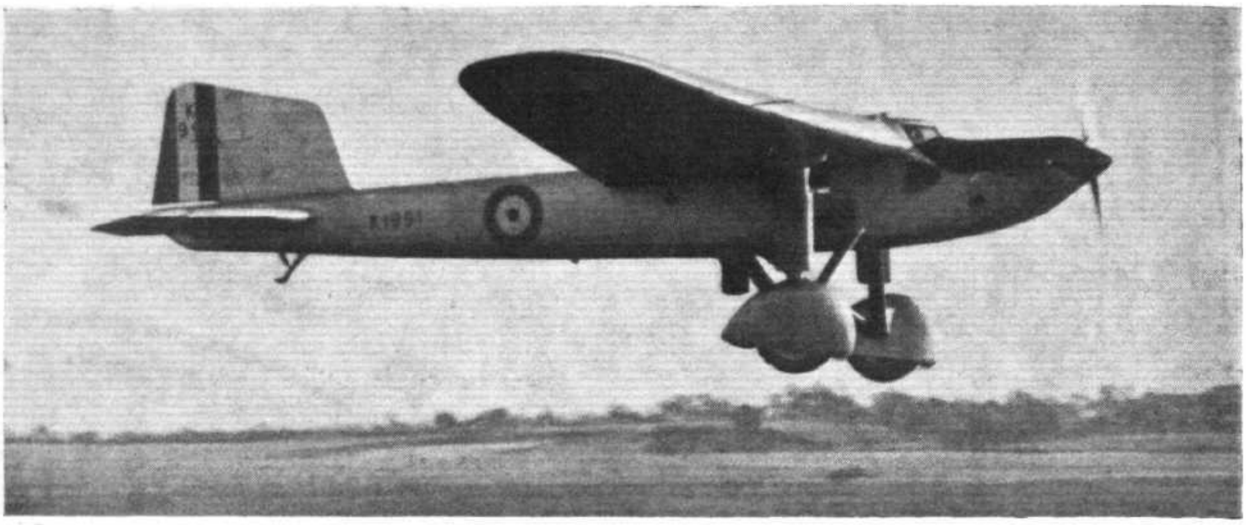
In this connection we may refer to the "R.A.F. Quarterly" prize essay of this year, which was written by Flt. Lt. F. M. Bladin, of the Royal Australian Air Force. The subject concerns the mobility of R.A.F. units for the purpose of reinforcing other commands. The writer notes that one of the principles of organisation laid down in an Army manual is that use should be made where possible of existing civil organisations. He continues: "The control of air routes along which it is desired to move British air forces is a question which demands consideration. The map shows that, considering the extent and distribution of the British Empire, it is well served by main air routes. The trouble is that the routes are not 'all-red' routes, and therefore complete freedom of movement in all possible political situations cannot be assured. In some places these 'foreign sections' are comparatively short and it is possible to establish an alternative route. From Capetown to Singapore, the longest foreign section is the strip along the Persian coast. If this portion of the route is ever changed it is to be hoped that the Arabian shores of the Persian Gulf will provide suitable facilities and that the friendship towards Great Britain of the coastal tribes will be maintained and developed. If the Persian route continues to be used by the private operating companies, it would appear necessary for the Royal Air Force to develop the alternative Arabian section. If this is not done, the mobility of British air units will be determined by the political relations which exist with a foreign Power!"

Only a few years ago we had a practical example of the need to reinforce the Air Force in India from Iraq. Had the Persian Government said us nay, we should not easily have been able to evacuate our Resident and the other foreigners from Kabul. Within the last few days we have had to send troops from Egypt to Cyprus by air. That is another story, but it illustrates our fairly frequent need to use the air for protection of our interests and the lives of our nationals. The Persian Gulf is a most important link in the R.A.F. chain. It is so important that Flt. Lt. Bladin's warning ought not to be disregarded; and if Imperial Airways continues to use the Persian side of the Gulf it may be necessary, as he states, for the Royal Air Force to develop the route on the Arabian side, so as to avert the possibility of India being aerially isolated from Iraq and the Middle East.

Two air routes down the Persian Gulf certainly smacks of extravagance in these days of economy. It would be far cheaper for the Air Ministry to give special assistance to Imperial Airways in the development of the Arabian shore route. If Persia refuses to renew the concession next April, we shall hardly regard it as an unmitigated misfortune.

**ENGLISH BEAUTY:** Few castles, if any at all in the world, can compare with Arundel Castle for sheer rugged grandeur. Our photographer caught this view from a Ford 5AT aircraft when visiting the Ford aerodrome which is a few miles further to the west. The Roman Catholic Church on the extreme right of the picture shows a striking contrast in architectural types, while the rest of the town sheltering below the Castle is typical of the way in which our older English towns have grown up. The Duke of Norfolk, whose seat is Arundel Castle, is our premier peer. His other titles include Hereditary Earl Marshal and Chief Butler of England.

(FLIGHT *Photo.*)



# The Fairey (Napier) Long Range Monoplane

*A sensible attempt on the long distance world record, which is in no way a stunt and which has every care bestowed upon it to ensure its success with a minimum amount of danger*

THE attempt which is shortly to be made on the world's long-distance record by the Royal Air Force Fairey (Napier) Long-Range monoplane is vastly different from the majority of world record flights in that it is definitely a Service flight. This means that everything possible has been done to ensure its success. The aircraft will not have to stagger off a specially prepared sloping runway many thousands of yards long, as has been the case on certain flights. It will not be forced to fly just above the trees for the first hours of its flight because its heavily overloaded state does not permit of a higher ceiling. No; it will just be straightforward flight with an aircraft peculiarly fitted for the job.

In the first place, there is no such special runway available in this country, and even at the huge aerodrome of Cranwell the run into the prevailing wind has to be done up hill! In the second place, our Royal Air Force is nothing if not thorough, and would not be a party to a "do or die" attitude for a flight of this kind. Quite a considerable number of miles' range have been sacrificed in order that the pilots may have certain equipment to increase their comfort and their efficiency—on a flight like this one might very well say and *therefore* their efficiency. When it is realised that every pound extra weight means one mile off the range, it will be seen how easy it is to throw away a great number of miles.

It will not be possible for anyone to suggest that more care might have been taken on this flight. All the essential instruments have been duplicated, and even quadruplicated in certain cases. Three altimeters are fitted, two being ordinary standard instruments, while the third is a small portable, but particularly sensitive, one. There are four compasses, two of the P4 type, one dashboard type, a P3, and one O3 for the navigator. There are two air-speed indicators, two Reid & Sigrist turn and bank indicators, and one S. G. Brown pitch and azimuth indicator. One of the most interesting features of the equipment is undoubtedly the use of "George" for all three axes. "George" is the automatic pilot about which there has been so much talk lately. In this aircraft he comprises two gyros, one to control the ailerons and the other to control the tail surfaces. This particular form of control has now reached the stage when it can be entirely relied upon to control an aircraft in the air far more accurately than a human being can do, and for such a flight as this it is eminently suitable. Its use will make flights of long duration through clouds and other bad conditions simple matters, thus giving the pilot time to

**The Fairey (Napier) Long Range Monoplane flying at Cranwell recently.**
(FLIGHT *Photo.*)


**The rudder of this year's Fairey (Napier) Monoplane has a new design of balance but the whole tail retains its extremely clean appearance.**

(Flight *Photo.*)

devote himself to navigation and so decrease his nervious tension, and thus his fatigue.

"George's" gyroscopes are driven by compressed air supplied from a small compressor driven by an airscrew, and air from the same source works a series of pistons which transmit the re-action of the gyro to the move-ments of the aircraft to the appropriate controls.

By the time this appears in print it is probable that a pre-liminary flight to Egypt will have been carried out. This flight is being undertaken in order that data may be obtained which will further add to the safety of the record flight to South Africa and increase the chance of it being an unqualified success.

Sqd. Ldr. O. R. Gayford and Flt. Lt. D. L. G. Bett are the pilots. Both have had experience on the annual Cairo to Cape flight by the R.A.F.

Sqd. Ldr. Gayford joined the R.N.A.S. in 1916 after having served with the R.N.V.R. He has seen service in the Ægean Sea, Russia, Somaliland, Constantinople, Iraq, Kurdistan and the Middle East. In 1928 he commanded the R.A.F. Cairo-Capetown flight, and in 1929 carried out a tour of the British West African Dependencies for the purpose of inspecting and advising upon sites for seaplane bases and aerodromes in those countries.

Flt. Lt. Bett entered the R.A.F. College at Cranwell in 1920, and after serving with No. 24 Squadron at Kenley he was in 1922 posted overseas to Helwan, in the Middle East command. In 1927 he took part in the R.A.F. Cairo-Capetown flight, under command of the late Air Commodore Samson. On returning to the Home Estab-lishment in 1928 he was posted to the experimental section at the Royal Aircraft Establishment, Farnborough, in charge of the engine research flight.

The Fairey (Napier) itself is in all essentials the same as the first of its type, which flew non-stop to India, and afterwards crashed on a hillside near Tunis when flying to the Cape, with the regrettable loss of Sqd. Ldr. A. G. Jones Williams and Flt. Lt. N. H. Jenkins. The main differences are its instrument equipment, and, as has already been pointed out, "George," as the automatic pilot is known, who will relieve the pilots of a great amount of the work. A new venting system, designed to minimise loss of fuel by evaporation and surging, has been incorporated in the petrol system. This consists of a collector box upon the centre portion of the wing, into which all tanks vent, a drain from this collector box is arranged to pass back any fuel which may have evaporated into it. The external finish of the machine looks some-what neater, and it is obvious that particular care has been taken to streamline every part as efficiently as pos-sible. This year the most obvious addition is the provi-sion of "spats" over the ~~Dunlop~~ Palmer wheels, an addition See Correction P. 1107 which is said to add several miles per hour to the cruising speed, although their weight, which is somewhere about 60 lb., materially decreases the total range of the machine. At all points, such as the top of the undercarriage com-pression legs, the inner ends of the axle and radius rods, care has been taken to see that these struts merge into the fuselage or wing, as the case may be.

The construction of the tailplane is interesting, as, apart from it being of thick section and full cantilever, extra hinge length is gained in a very ingenious manner. This is achieved by making the hinge the full length of a small fixed portion, which is the apex of the whole triangular tailplane and projects some 14 in. on each side of the fuselage. The remainder of the tailplane hinges on this portion when the tail adjusting gear is used, and is stepped round it in much the same way as a horn balance steps round the end portion of a wing.

The Fairey Aviation Co., of Hayes, are, of course, as before, the builders, while the engine is an almost normal type Napier "Lion" of about 530 h.p., but with the carburetters specially tuned for economy, and slightly higher compression ratio pistons fitted. The engine drives a Fairey metal airscrew, and from the spinner right back to the fuselage the fairing lines are very clean. The fuel capacity is over 1,000 gallons, the majority of which is in the wings, where eight tanks are situated; these feed by gravity to a 42-gallon tank in the cabin, from whence it is pumped to the engine. As a safeguard a hand pump is also installed, while direct gravity feed can be used if required. Another safeguard against engine failure is the fitting of duplicate main oil filters, so arranged that either may be cleaned in flight. Although the engine uses practically no water at all during flight, no risk is being taken that the supply should fail, and a tank is fitted in the wings holding a 40-gallon reserve. This water also forms part of the desert ration in the case of forced landing where water is unprocurable.

The pilot's cabin is, of course, totally enclosed, and full provision is made for cleaning all the windows. There are also windows on the underside of the wings, through which the pilot can look downwards, and similar ones on the lower side of the fuselage upon which a system of drift lines has been arranged. A hole in the roof is arranged so that sextant readings and compass bearings may be taken for navigation purposes. Particular care has been taken to ensure a reasonable degree of comfort for the pilots,

**(Left to right) Flt. Lt. D. L. G. Bett and Sqd. Ldr. O. R. Gayford, the pilot of the Fairey (Napier) Long Range Monoplane.**

(Flight *Photo.*)

**Mr. F. Rowarth explaining the details of the tailplane to a friend. The mass of calculations he has made for the flight appears to have furrowed his brow somewhat.** (FLIGHT *Photo.*)

both when at the controls and when in the cabin behind. The pilot's seat can be raised and lowered, while the back is adjustable for angle. The rudder bar has large foot plates, fitted with thick Sorbo pads, in place of the usual pedals. The seat provided for the second pilot in the cabin is of the lounge chair type with padded neck and knee rests. It can be used for sleeping if desired.

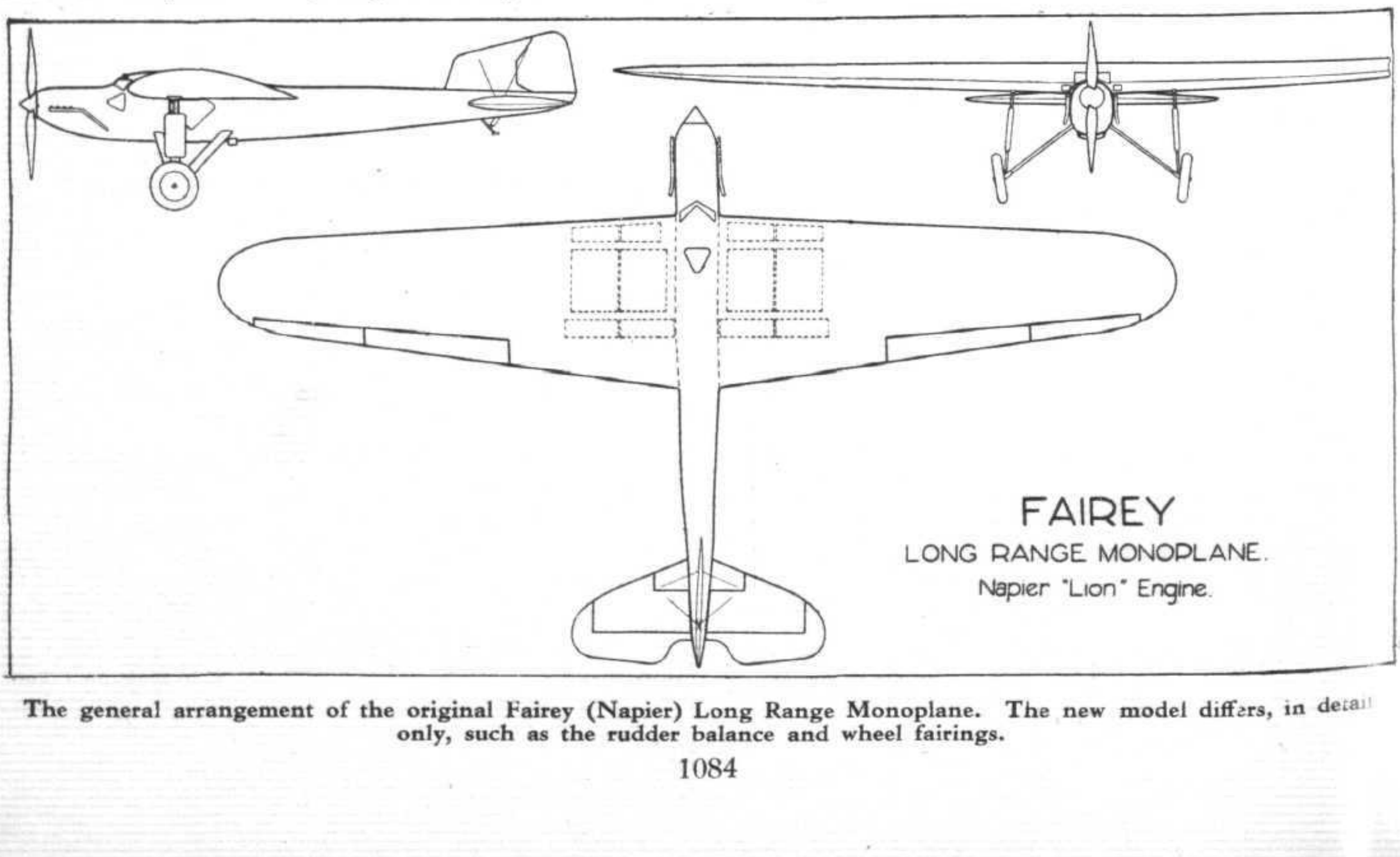
A short-wave wireless transmitting set is fitted which will be used to transmit routine reports giving the aircraft's position every two hours. The call sign is GEZAA and the wave length 33.71 m. In this connection private wireless stations are asked to refrain from transmitting on this wave length so as to obviate unnecessary jamming and thus the reception of any urgent messages. The Air Ministry has arranged for wireless stations in the United Kingdom, Malta, Ismailia and Aden to keep special watch for signals, but it will also be glad to have authentic reports passed to it which may be picked up by private stations. No receiving apparatus is carried, because it is felt that not only would the extra weight not be justifiable, but also there is little of value which could be sent to the aircraft during the flight, as there are no stations which can send reliable weather reports after the machine has left Europe. It will be possible for an aerial to be rigged and messages sent out should a forced landing occur during the flight.

As an example of the extreme care which has been taken to ensure that this machine is the best which can be made for this particular job, the following tests carried out before and during the building of the original aircraft may be quoted: (*a*) Exhaustive wind tunnel tests were made at the National Physical Laboratory in order to ascertain the aerodynamical characteristics of the various parts. (*b*) A complete half-wing was tested under full load for all conditions of flight. (*c*) The complete fuselage was tested for torsional rigidity by loading up the fin and tailplane. (*d*) A wheel was loaded beyond anything which will occur during landing, without any sign of failure. (*e*) An identical engine was run on the bench for **70** hr. under the same conditions as will be found during the flight. Needless to say all these tests were entirely satisfactory.

No description of the preparations for such a carefully planned flight would be complete without mention of the official who is responsible for all the technicalities and calculations of the flight. This is Mr. F. Rowarth, who carried out similar duties on the last attempt. Mr. Rowarth is employed at the Royal Aircraft Establishment, Farnborough, and is well known to readers of FLIGHT for the accurate way in which he and Capt. Dancy handicap any and every type of machine for air races. His is an extremely arduous but interesting and varied job, and the success of the flight will in no small measure be due to his careful preparation. For example, the pilots do not just get in and fly at whatever speed and height they think suitable. A very carefully prepared log has been got out for them, and after taking off they will climb steadily at a very gentle rate, aiming to be at **6,000** ft. shortly before getting to the African mountains. They will be given in this log a table of engine revs, air speed and fuel flowmeter readings, upon which to fly, thus ensuring that they are doing so in the most economical manner. The flowmeter is interesting and is a type which has been developed at Farnborough. It is now exceptionally accurate, and even in the worst conditions has never been found to be more than 2 per cent. in error.

The main dimensions of the Fairey (Napier Monoplane R) are:—

Span, **82** ft. (**25.0** m.).
Length, **48.5** ft. (**14.8** m.).
Chord (mean), **11** ft. (**3.3** m.).
Height, **12** ft. (**3.6** m.).




**The general arrangement of the original Fairey (Napier) Long Range Monoplane. The new model differs, in detail only, such as the rudder balance and wheel fairings.**

Take-off tests have already been carried out, and loaded to about 15,000 lb. (that is, 2,000 lb. less than full load); the take-off run was only 850 yd. The total run available on the Cranwell aerodrome is over 2,000 yd., so there should be no difficulty with the take-off when fully loaded.

The route to be followed for this flight to Egypt will be from Cranwell via Dungeness, Cayeux-sur-Mer (about 20 miles north-east of Dieppe), Berre (14 miles from Marseilles), Mount Cinto (Corsica), Tunis, Ben Gardane (Tunisia), Bishire (Lybia) to Abu Sueir aerodrome in Egypt, an approximate distance of 2,857 miles. It is expected that the aircraft will reach Tunis about dusk on the day it leaves Cranwell, arriving at Abu Sueir about noon (G.M.T.) on the following day. The return flight, which is due to leave Egypt by about November 6, is planned in one stage to Malta on the first day and the next stage to Cranwell on the following day.

Since the above was written, the trial flight to Egypt has been successfully accomplished. After waiting some days for favourable weather forecasts, the monoplane took off from Cranwell at 7 a.m. on Tuesday, October 27. The machine passed over Paris at 10.23 and over Nice at 4.4 p.m. At 6 p.m. the pilots reported to the Air Ministry that they were over the Straits of Bonifacio (between Sardinia and Corsica), flying blind through a thick cloud. At 10 p.m. they reported that they were nearing Tunis. Next day, Wednesday, 28th, the monoplane landed at Abu Sueir, in Egypt, at 2.15 p.m.

# Airport News

## CROYDON

NEARLY every morning this week, until 9 or 10 o'clock, Croydon has been shrouded in a thick mist, although it has not been bad enough to stop flying, because just beyond Croydon the weather has been perfect. I was informed a few days ago, by someone who should know, that Croydon was chosen as the Air Port of London, on account of its freedom from fogs. This appears to be a fallacy as far as Croydon is concerned; often it is enveloped in fog, while a few miles away weather is very good.

On Wednesday evening, about 5.30 p.m., the electric light supply failed, and the whole aerodrome was plunged into darkness. It happened at a time when most of the staff were on the point of going home, so very little inconvenience was caused. Within a short time, however, the aerodrome was fully alight again, having been switched over to the emergency supply.

The aerodrome hotel has introduced some entertainment into its programmes. Every Friday evening an artiste entertains in the lounge, and on Saturday afternoons a tea dance is held. It is a great pity that a real first-class band is not engaged by Messrs. Barclay Perkins; it would attract a lot of people.

A Farman belonging to the Compagnie Française Aerienne arrived on Friday, from Paris, with passengers. It is not often machines belonging to this company come to London. It was, of course, a special charter.

Standing on the aerodrome one morning this week, my attention was drawn to the Fokker F.VII B, belonging to the Belgian Sabena Company. This machine is scheduled to leave for Brussels at 9.30 a.m. On this occasion it was taxied into position on the departure area at 8.55 a.m., and for the 35 min. before it left, the three engines were left running. This is quite a regular occurrence, the point that strikes one being the enormous waste of fuel. It is very profitable for the petrol and oil companies, but what would the Belgian taxpayers, who help to subsidise the air lines, say to it? In twelve months thousands of gallons of petrol must be wasted in this manner.

The fine weather is keeping private owners about, there being plenty of them in and out of Croydon every week. Col. Darly's little "Aeronca" took the air again on Friday, after several months in the hangar. It is a pretty little machine to watch, but rather gives one the impression that it is a toy, and not a machine for real use.

The traffic figures for the week were:—Passengers, 828; freight, 79 tons.

P. B.

### Royal United Service Institute Lectures

AMONGST the lectures to be delivered before the Royal United Services Institute, Whitehall, S.W., during the session 1931-32, will be the following concerning aviation:—

**1931**

*Nov.* 18.—"Flying Boats in Empire Defence," by Wing-Comdr. R. M. Bayley, D.F.C., R.A.F. Air Vice-Marshal R. H. Clark-Hall, C.M.G., D.S.O., in the chair. (3 p.m.)

**1932**

*Feb.* 4.—"A Flight to Abyssinia," by Sqdn.-Ldr. J. L. Vachell, M.C., R.A.F. The Rt. Hon. Sir Philip Sassoon, Bart., P.C., G.B.E., C.M.G., M.P., in the chair. (5 p.m.)

*Mar.* 16.—"The Development of Naval Air Work," by Commodore N. F. Laurence, D.S.O., R.N. Vice-Admiral F. C. Dreyer, C.B., C.B.E., in the chair. (3.30 p.m.)

*Mar.* 23.—"High-Speed Flying," by Sqdn.-Ldr. A. H. Orlebar, A.F.C., R.A.F. Air Marshal Sir Edward Ellington, K.C.B., C.M.G., C.B.E., in the chair. (3.30 p.m.)

*April* 13.—"The N.W. Frontier of India," by Maj.-Gen. S. F. Muspratt, C.B., C.S.I., C.I.E., D.S.O. Field-Marshal Sir Claud W. Jacob, G.C.B., G.C.S.I., K.C.M.G., in the chair. (3.30 p.m.)

### R.Ae.S. Lectures

MR. H. B. IRVING, and Mr. A. V. Stephens, who are lecturing on "Safety in Spinning" before the Royal Aeronautical Society on Thursday, November 5, will show the model vertical tunnel and demonstrate how spinning models are kept under observation. They will also show films of spinning and a number of slides. The lecture will give an account of the work on spinning and the progress which has been made since S. B. Gates and L. W. Bryant read their historic paper before the Society four years ago. Safety in spinning is perhaps one of the most urgent problems for which a complete and satisfying solution is awaited, and the conclusions which the authors put forward for attaining safety are the results of the long series of model and full scale experiments and observations which have been carried out. The lecture is at 6.30 p.m. in the Lecture Hall of the Royal Society of Arts, 18, John Street, Adelphi, W.C.2.

Capt. W. J. McDonough, head of one of the leading Canadian transport and exploration companies in Canada, is paying a short visit to this country. Capt. McDonough, who has had a very wide experience of Canadian conditions, has agreed to lecture before the Society, in conjunction with the Society of British Aircraft Constructors, on aeroplanes as an aid to mineral exploration and the operation of aircraft in sub-zero temperatures. He will show a film illustrating exploration work in Canada from the air and a number of unique slides. Owing to the shortness of the notice, it has not been found possible to arrange for the lecture and film at the Royal Society of Arts, so will those who wish to attend make particular note of the *change* from the usual day and place? The *day* is *Monday*, November 9, at 6.30 p.m., and the *place*, the Gaumont Film Company's Theatre, Film House, Wardour Street, W.1.

### "Some Flying Experiences of a Private Owner"

ON Wednesday, November 11, at 5 p.m., Col. The Master of Sempill will deliver a lecture on "Some Flying Experiences of a Private Owner" at the Portland Hall, Regent Street Polytechnic, in aid of King Edward's Hospital Fund. Admission to the lecture—which is one of a series on Tales of Travel and Adventure, illustrated by lantern slides or cinematograph—is 2s. 6d., or, numbered and reserved seats, 5s. Tickets may be obtained from the Secretary, King Edward's Hospital Fund, 7, Walbrook, E.C.4, or from Alfred Hays, Ltd., booking agencies.

# Airisms from the Four Winds

**The Blackburn Demonstration Tour**

THE three Blackburn machines, the "Segrave" four-seater cabin monoplane flown by Capt. A. M. Blake, the firm's chief test pilot, with Mr. J. Shearman, engineer, as passenger, the "Bluebird" light aeroplane flown by Capt. H. J. Andrews, Blackburn's foreign representative, and the "Lincock" single-seater light fighter, flown by Capt. T. N. Stack, which are making a demonstration tour of Europe, completed their outward journey when they landed at Athens in the afternoon of Wednesday, October 21. Here they rejoined Mr. R. Blackburn, the Chairman and Managing Director of the Company, who started out with the tour from England in the "Segrave," but finished his journey by rail from Cologne to Athens, having appointments there and insufficient time to attend all demonstrations. Leaving England on October 5, the three machines gave demonstrations at Brussels on October 5 and 6, at Prague on the 12th and 13th, at Vienna on the 15th, at Budapest on the 16th, and at Belgrade on the 19th. While the original schedule, by which they were due to arrive at Athens on October 11, has been considerably exceeded, due to longer time being spent on demonstrations, etc., the only unavoidable delays have been one day at Brussels due to bad weather and one day at Cologne due to loss of pressure in an undercarriage oleo leg of the "Lincock" and the necessity for having a pressure pump sent out from England. At Athens the tour will remain for a few days, making a thorough inspection of the machines and giving demonstrations before the Greek authorities. On the results of the tour on the outward journey also a decision regarding the return route will be made, whether the tour will be extended to Turkey or return direct via Bulgaria, Rumania, Warsaw and Germany.

***The Hamilton Brothers Start for Australia***

MR. LESLIE HAMILTON and Mr. Kenneth Hamilton flew in their D.H. "Puss Moth" from Hanworth to Lympne on October 24 in order to start on their attempt to beat the England-Australia record. Unfavourable weather reports prevented an immediate start, but on October 27 they set out at 12.30 a.m. on the first stage of their journey. Losing their bearings in dense fog, they were forced to land at dusk at Tullin, near Vienna.

**Bert Hinkler's New York-Jamaica Flight**

ON October 27 Bert Hinkler, the Australian pilot (who "invented" the England-Australia flight record!) accomplished an 18-hr. non-stop flight from New York to Kingston, Jamaica.

**Graf Zeppelin**

THE German airship *Graf Zeppelin*, which last week accomplished yet another flight from Germany to Brazil, arrived over Rio de Janeiro from Pernambuco on October 22. Returning to Pernambuco, the airship started on the homeward flight to Friedrichshafen on October 24. On October 27 she reported strong head winds, but arrived safely at Friedrichshafen at 5.30 a.m. on October 28.

**Miss Ruth Nichols' Long Flight**

MISS RUTH NICHOLS, the American airwoman, flew from Oakland, California, to Louisville, Kentucky—a distance of 2,000 miles—on October 24-25. When taking off next day from Louisville for New York her machine caught fire, but she managed to escape uninjured.

**The Outbreak in Cyprus**

ON the occasion of the outbreak in Cyprus, when a crowd burnt down the residence of the Governor, seven Vickers "Victoria" troop-carrier aeroplanes were moved up from Cairo to Alexandria. There they took on board 150 men of the King's Regiment, and, early in the morning of October 23, they left for Cyprus. They landed at Nicosia aerodrome in the island, having covered the distance of more than 550 miles in 7½ hr. They arrived just in time to quiet a crowd which was threatening to attack the Government offices. Two days later a flight of No. 45 (Bomber) Squadron (Fairey III.F) also arrived at Nicosia from Egypt. A small party of R.A.F. men with a supply of petrol and a wireless installation was later sent from Port Said to Famagusta on a small steamer.

**Vickers "Vildebeest" for Spain**

AFTER an extended series of competitive trials the Vickers "Vildebeest" torpedo bomber twin-float seaplane has been chosen by the Spanish Ministry of Marine as the standard aircraft of its class to be adopted for the re-equipment of the Spanish Naval Air Service. A large number of these machines fitted with the Spanish-built Hispano Suiza type 12 Lbr. engine are to be built under licence at the works of "Construcciones Aeronautics S.A.," which are situated at Cadiz. One complete sample machine will be sent out from the factory of Vickers (Aviation), Ltd., at Weybridge; most probably it will be flown to Cadiz, where it is expected that the work of construction of the first batch will commence almost immediately. A most successful tour of Northern Europe and the Scandinavian ports has just been concluded with a machine of the same type. The British Air Ministry is adopting the Vickers "Vildebeest" fitted as a landplane and with the Bristol Jupiter X.F.B.M. motor. The construction of a number of these machines for the Royal Air Force will shortly be proceeded with.

**Bombing the "Centurion"**

No. 101 (Bomber) Squadron, the only squadron in the R.A.F. which flies the Boulton and Paul "Sidestrand" with twin "Jupiter" engines, has been engaged in bombing practice directed against the old warship H.M.S. *Centurion*, the latter being under way and moving zig-zag at the time of the practice. One object of this practice was to discover whether a twin-engined aeroplane made a steadier platform for bomb-dropping than is afforded by a single-engined machine. Various experimental devices were also tried out during this practice. Bombs were dropped from a height of 5,000 ft. Maj. Turner, of the *Daily Telegraph*, understands that the percentage of hits was about 80.

**Junkers Jumo 4 makes Forced Landing**

DURING a test flight recently a Junkers type G.24 had to make a forced landing on a small wood near the Dessau aerodrome of the Junkers Company. The machine was being used for flying tests of the Junkers heavy-oil engine, and the forced landing was due to the failure of a fuel meter mounted in the cabin. This meter cut off the fuel supply to the engine, and the forced landing resulted. Although the wings were badly broken up, including the inner ends where are housed the fuel tanks, the pilot suffered no injury, and the machine did not catch fire, as it probably would have done had it been fitted with a petrol engine.

**Focke Wulf "Ente" in England**

SOME months ago we stated that it was hoped that the Focke Wulf "Ente" tailless machine would visit England so that those interested might see it in flight. Arrangements have now been made for this unorthodox machine to visit Hanworth during the period October 30-November 2. The Focke Wulf "Ente" was described and illustrated in FLIGHT of January 2, 1931, and it may be recollected that the *raison d'être* of the design is immunity from stalling, and consequently safety from the danger of spinning.

**Awaiting the Election Results at Hanworth**

A LARGE and cheerful crowd gathered at Hanworth on Tuesday evening, October 27, to make merry while awaiting the results of the polls to be published. No one appeared to have expected quite such a preponderous number of Conservative gains, and as each fresh victory of this party was announced the enthusiasm of those present increased greatly. Flt. Lt. Preston worked hard smoking slides over a candle so that he could write the latest reports on the glass and project them from his magic lantern on to the wall of the ballroom. In between each announcement the band provided people with an incentive to dance, and so well did they achieve their object that they had often to cease giving encores from sheer exhaustion. The fog, of course, was a very serious setback to the success of the evening, for, although Hanworth is very close to London and easily got at in normal weather, such a night as Tuesday makes it extremely difficult for those who travel by road. We ourselves arrived when several people had got as far as the aerodrome, at which point they seemed to have lost all sense of direction, and at least one man explained afterwards that he had made three circuits before finally coming in to the clubhouse to land.

The AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

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CONTENTS



## THE RACING AIRSCREWS OF 1931.

By D. L. Hollis Williams, B.Sc., A.F.R.Ae.S.

*Of the problems connected with the design of the high-speed machines for the Schneider Seaplane Contest, not the least fascinating was that of the airscrews. It must be realised that, although these machines have a very low power loading, they also have an extreme speed range—something in the neighbourhood of 4 to 1—which complicates the problem considerably, since to get good propeller efficiency at maximum speed it is unavoidable that at low forward speeds during take-off the airscrew is badly stalled. Nor is this all. Owing to the great torque and to the rotation of the slipstream, the machines have a tendency to swing during the earlier stages, and although this difficulty can be reduced in future aircraft designs by re-designing the fin areas, such changes could not conveniently be made in this year's machines.*

*We consider ourselves very fortunate in having succeeded in persuading Major T. M. Barlow, Chief Engineer of the Fairey Aviation Co., Ltd., to get Mr. Hollis Williams, head of the Fairey Technical Department, to write an article on the problems connected with the design of the metal airscrews for the 1931 Schneider machines. Mr. Hollis Williams does not, unfortunately, go into very great detail, and does not, for example, give the values of thrust and torque coefficients, nor does he indicate the actual propeller efficiencies achieved. It is believed that these were very high, but until a more detailed account is given it is impossible to form an estimate. It is thought, however, that the general survey of the problems made by Mr. Hollis Williams will be found of interest to many whose work is connected with the design of airscrews.*

*It is of interest to recall that the Fairey Aviation Company has produced the metal airscrews for the Schneider machines in three successive contests: 1927, 1929 and 1931. Mr. Hollis Williams refers very briefly to the relative ease with which re-setting of blades to different pitch angles can be made. This feature is, of course, shared by Fairey metal airscrews for all types of aircraft.*

The Fairey Aviation Company, as in previous years, was again entrusted with the design and manufacture of the airscrews for the 1931 racing seaplanes which retained the Schneider Trophy for England, and which set up the magnificent new world's speed record of 407.5 m.p.h.

The 1931 high-speed successes were not due to any radical departure in aeronautical engineering, but to the sound development of the work carried out in and prior to 1929.

Due no doubt in some measure to the late start that was made, brought about by the political situation, the new seaplanes were developments of the S.6A machine of 1929, with modifications introduced, where necessary, to cope with the extra cooling and fuel capacity required to make full use of the extra power available.

In these circumstances it was to be expected that the design of the 1931 airscrews would be based on the principles established in 1929, which in turn were due

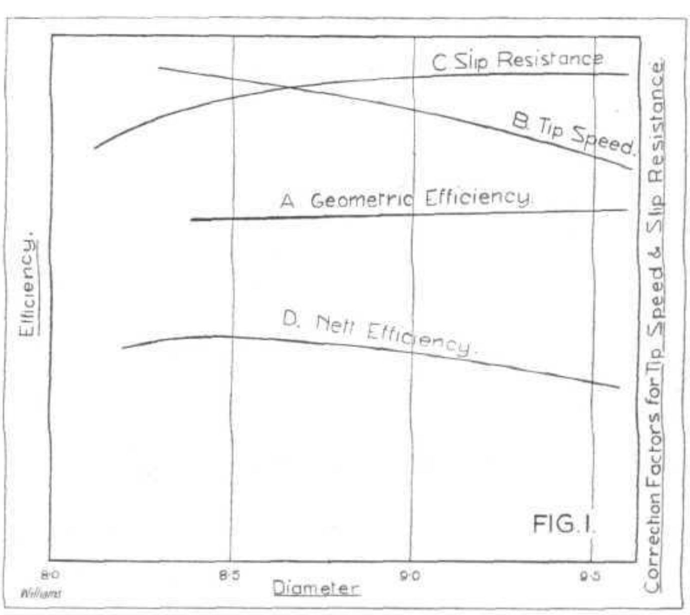



**Fig. 1.—Variation of efficiency with diameter.**

to the experience gained during previous contests, particularly the 1927 research, for the inauguration of which the credit must be given chiefly to the late P. A. Ralli, of the Fairey Aviation Company, for which work he was awarded the Royal Aeronautical Society's Silver

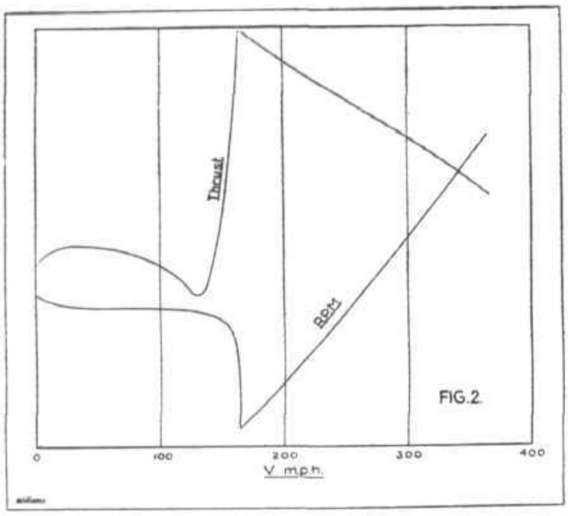



**Fig. 2.—Calculated performance of a typical racing airscrew. Thrust and r.p.m. are non-dimensional.**

Medal on the occasion of his lecture on the 1927 Schneider Race.*

No attempt will be made to enter into the detail of design, which is beyond the scope of this article, and it will not be possible to publish exact data; but it is thought that a general survey of the problem may be interesting to many who are concerned with airscrew design.

The design problem is fundamentally the same as for less extreme conditions. In fact, in some respects it is easier, because some aspects of performance, such as climb and quickness of take-off, do not matter, and so long as the machine will take off even in calm weather, that is sufficient, and apart from keeping this requirement in mind, the designer can concentrate entirely on top speed efficiency.

The overall efficiency is the geometric efficiency—that is, the efficiency depending purely on blade angle and aerofoil characteristics—reduced by some factor to allow for compressibility effects due to the excessive speed at which the outer sections may be moving, and by another factor to account for the extra resistance experienced by parts of the machine immersed in the slipstream.

High aerodynamic efficiency is obtained by arranging for all the aerofoil sections of the blade to work as nearly as possible at optimum attitudes.

It is possible to provide various combinations of blade breadth and pitch which, within small limits, will have the same top speed efficiency, but will have widely differing characteristics at take-off, and with this in mind it is necessary to make a wise selection.

Tip speed losses are avoided as far as possible by choice of engine gear ratio and airscrew diameter.

The reduction in diameter resulting from these considerations cannot be carried too far, however, since the slipstream becomes concentrated into a smaller area, with a consequent rise of velocity, with the result that the resistance of parts of the aircraft immersed in it will increase.

A fine balance must be drawn, therefore, between the variation of the several factors which contribute to overall efficiency and airscrew diameter.

Reference to Fig. 1 will show this graphically.

Curve (A) shows the variation of geometrical efficiency with diameter for a typical family of high-speed airscrew designs.

* "The 1927 Schneider Race."—R.Ae.S. Journal, Sept., 1928.

Curve (B) shows the tip speed loss increasing with diameter.

Curve (C) shows the slip resistance loss decreasing with diameter.

The three curves are combined in the overall efficiency curve (D) which reaches a peak value at a diameter of 8 ft. 6 in.

The policy of no compromise on top speed efficiency led to the adoption of this diameter for design, although the power loading per square foot of disc area was clearly very high.

This power loading has steadily increased with each successive Schneider Race, but until this year there was no indication that it would present any serious difficulty. Actually, as will be described subsequently, difficulty of handling on the water was encountered, which could on future designs be avoided by suitable fin and rudder design, but on an existing machine was most easily overcome by change of airscrew design.

Wind channel tests carried out at the N.P.L. confirmed that this choice of design was correct for the particular top speed conditions, because, in spite of less favourable conditions of operation, the overall efficiency was found to be as high as that of the airscrews used in the 1929 contest.

## Take-Off.

In spite of the very high ratio of power to weight, the take-off of racing seaplanes is always a matter of some difficulty. This is due to the following causes:—

(*a*) Low thrust due to stalled blades;
(*b*) Swinging due to torque reaction effects;
(*c*) Swinging due to rotation of slipstream.

The stalling of the airscrew blades is brought about by the steep pitch necessary for top speed, which under static conditions leads to the blades operating at an angle of incidence of very nearly 40 deg.

It will, therefore, be realised that the thrust com-

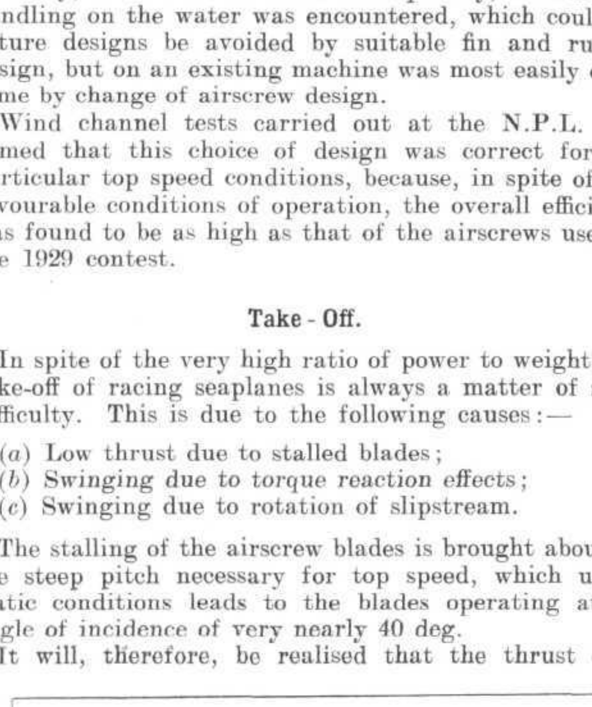



**Fig. 3.—Variation of Twist of Slipstream with Speed Calculated for an 8 ft. 6 in. diameter airscrew.**

ponent of the resultant air force is small, so that in spite of the two thousand b.h.p. available, the thrust is considerably less than that of a normal service seaplane with a 500-h.p. engine.

The performance characteristics of a typical racing air-

screw are shown in Fig. 2, and it will be seen that the blades do not pass out of the stalled condition until the comparatively high forward speed of 160 m.p.h. has been reached.

At angles of attack in the neighbourhood of 40 deg., as the resultant air force does not change greatly in magnitude or direction for small changes of incidence, the greatest thrust is obtained by using as much engine power as possible.

Therefore the design which leads to the smallest range of r.p.m. without reducing top speed efficiency, will give the best airscrew for take-off.

Swinging troubles at slow speeds on the water are due partly to torque effects and partly to the rotation of the slipstream.

The momentum imparted to the air stream is reacted on the water at the floats, which at slow speeds, before planing starts, causes a greater displacement of one float than the other. This effect is to some extent minimised by carrying more fuel in one float than the other, but is not entirely avoided.

The float which has the greater displacement also has more resistance, with the result that a swinging tendency is produced.

Another factor which contributes to the difficulty of handling the machine on the water is the swirl of the slipstream.

The enormous engine power is absorbed by imparting rotational energy to a disc of air only a few feet in diameter and because at low rates of advance the outflow is comparatively slow, the angle of twist of the slipstream tends to become very large.

The effect of the rotary stream striking the fin, if, as is usually the case, this is situated entirely above the rotational axis, is to produce a swing in the same direction as that due to float drag, and the angle of twist at slow rates of advance may be large enough to stall completely the fin and rudder if the available rudder travel is small. This may be seen by reference to Fig. 3, which is the calculated angle of twist for a representative radius of an 8 ft. 6 in. diameter airscrew.

As, however, it has usually been found impossible to correct the initial swing it was not anticipated that this would prove a serious handicap.

The pilots of high-speed seaplanes normally open up at a considerable angle out of wind so that they will have accelerated to sufficient speed to regain directional control by the time the machine has swung into wind.

On the preliminary trials by Sqd. Ldr. Orlebar with the first of the new airscrews, it was found, however, that the swinging tendency was so powerful that only once during a series of runs was the swing mastered.

On this account it was decided that larger diameter airscrews would need to be used even at the expense of top speed efficiency, provision having been made for this possibility in the design of the blanks from which the airscrews are formed. Actually, the difference of efficiency between the calculated ideal design and one which gave comfortable handling on the water resulted in a loss of the order of 1 per cent. on speed, so that no great sacrifice was involved, as this is well within the difference of speeds obtained with the same combination of engine and airscrew on different days.

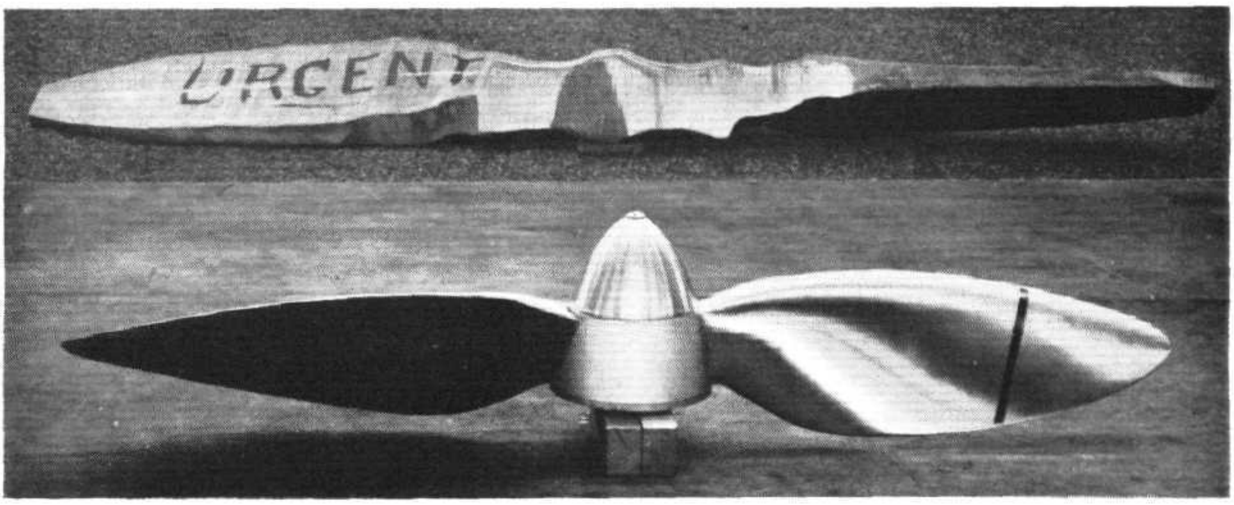
That is an outline of the problems of design and to complete the article a brief survey of the manufacture of the airscrews will be made.

The airscrews are made from duralumin forged blanks which arrive at the Fairey Aviation Company's works weighing about four times the finished weight.

The accompanying photographs of a blank as received and the finished airscrew will give some idea of the amount of work involved in producing a racing airscrew.

A certain amount of machining is possible, but a great deal of hand shaping is inevitable. After machining the blades are twisted to the correct pitch angles with, of course, the usual processes of heat treatment and inspection at each stage.

It is remarkable that in spite of the manufacturing difficulties of this type of airscrew extreme accuracy of blade shape is obtained, and the angles of the blades at each station do not vary by more than a few minutes of arc from the specified pitch angles.




**First and last stages: The upper photograph shows a racing airscrew blank as it was received by the Fairey Aviation Co., Ltd., while the finished product fashioned from it is shown in the lower photograph.**

The fitting of hub and spinner are each very specialised jobs. The special type of hub requires the greatest care and skill in assembly, in order to transmit the high torque safely. The hub design is good and no trouble has been experienced in this respect.

The spinner incorporates a unique form of construction devised by the Fairey company after much experimenting, and has given perfect service under the very exacting conditions of high-speed flying.

The balancing, both statically and dynamically, of the finished airscrew has to be done with the greatest care because any vibration added to the already highly stressed engine parts would probably result in a disastrous mechanical failure of the power plant.

The dynamic balancing is carried out on a special spinning plant recently installed by the Fairey Aviation Company, and all periods are cured by small modifications to the mass distribution of the airscrew.

If, as a result of trial flights, adjustments of airscrew speed are required to meet various conditions, this can be done with the greatest ease, and on occasion the airscrews have been returned for correction to pitch of the order of one quarter of a degree to set the airscrew exactly on to some pre-arranged top speed r.p.m.

## TORSION IN THIN CYLINDERS.

By E. H. ATKIN, B.Sc. (LOND).*

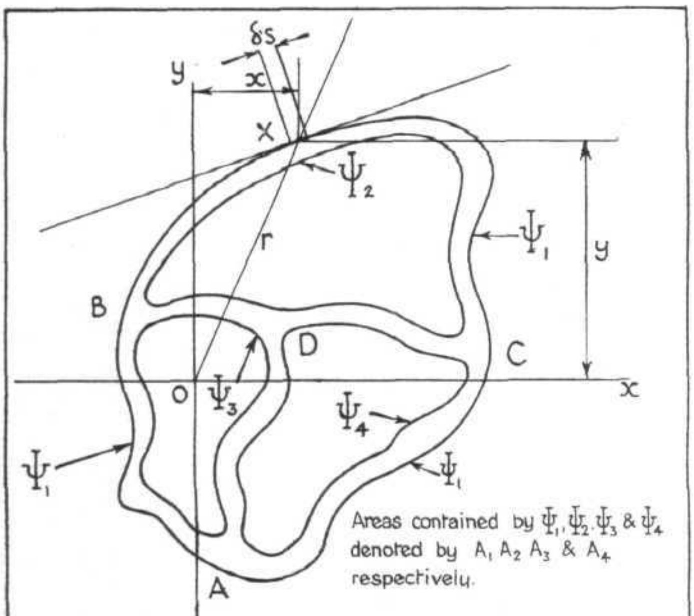
(*Concluded from p.* 72)

### (iii) The Stresses in multiply-connected Cross Sections.

The following theory, as will be seen, can be extended to sections of any degree of connectedness, but to avoid too "highbrow" a notation, the quadruply connected section of Fig. 5 will be considered.

The significance of the symbols used is indicated on the diagram.

To calculate the torsional resistance of the section, take moments of the resultant shear tractions all round the section about some point O.




QUADRUPLY CONNECTED SECTION

FIG. 5.

To do this, we remember the expressions given above for the components of shear parallel to the $x$ and $y$ axes, viz. :— $G\theta\dfrac{\partial\Psi}{\partial y}$, $-G\theta\dfrac{\partial\Psi}{\partial x}$. Hence the torque T is at once given by

$$T = -G\theta\iint\left(x\frac{\partial\Psi}{\partial x} + y\frac{\partial\Psi}{\partial y}\right)dxdy.$$

By Green's Theorem, we may write

$$T = -G\theta\int\Psi\frac{d\left(\frac{r^2}{2}\right)}{dn}ds + 2\,G\theta\iint\Psi\,dxdy.$$

The double integral is to be taken all over the section, and the single integral all round the boundaries of the section. $\delta n$ is measured positively outwards.

Evaluate the single integral first : for the external boundary $\Psi_1$, the corresponding part of

$$\int\Psi\frac{d\left(\frac{r^2}{2}\right)}{dn}ds \text{ becomes } \Psi_1\int r\frac{dr}{dn}dx = -2\,\Psi_1A_1;$$

(see Fig. 5 for notation)

for the internal boundary $\Psi_2$ is added the term $2\Psi_2A_2$,

hence the single integral may be written

$$2\,G\theta\,(\Psi_4A_4 + \Psi_3A_3 + \Psi_2A_2 - \Psi_1A_1).$$

Now to evaluate the double integral : the contribution of the part, say, $B \times C$, may be written down if it is assumed that the mean value of $\Psi$ for this part may be taken.

This part of the integral is therefore,

$$\frac{\Psi_1 + \Psi_2}{2}A_{B\,X\,C}$$

where $A_{B\times C}$ is the area of the section B X C of the complete section. Forming all such terms for the sections, and adding them together, we have

$$\frac{\Psi_1+\Psi_2}{2}A_{B\,X_C} + \frac{\Psi_1+\Psi_4}{2}A_{AC} + \frac{\Psi_1+\Psi_3}{2}A_{AB} + \frac{\Psi_2+\Psi_3}{2}A_{BD} + \frac{\Psi_4+\Psi_2}{2}A_{CD} + \frac{\Psi_3+\Psi_4}{2}A_{AD}$$

There is a certain degree of indefiniteness at points such as A, B, D, C, where the walls meet, but as they are assumed thin, no great error can arise. We may write therefore

$$\frac{\Psi_1}{2}(\text{Area circuit AB} \times \text{C}) + \frac{\Psi_2}{2}(\text{Area circuit B} \times \text{CD}) + \frac{\Psi_3}{2}(\text{Area circuit ABD}) + \frac{\Psi_4}{2}(\text{Area circuit ADC}).$$

Writing $A\Psi_1$ for compactness, in place of "Area circuit AB × C," and so on, the complete expression for the torque becomes,

$$T = G\theta[2\Psi_4A_4 + 2\Psi_3A_3 + 2\,\Psi_2A_2 - 2\,\Psi_1A_1 + \Psi_1A\Psi_1 + \Psi_2A\Psi_2 + \Psi_3A\Psi_3 + \Psi A\Psi_4] \;\ldots\ldots\; (A)$$

It is quite easy to see that equations (1) to (3) are to be derived as simple cases of (A). In the general case, however, equation (A), containing as it does four out of the five quantities $\theta$, $\Psi_1$, $\Psi_2$, $\Psi_3$, $\Psi_4$, at present undetermined, is not sufficient to solve our problem. Hence three more relationships between these quantities must be found. (Any one of the four quantities $\Psi_1$, $\Psi_2$, $\Psi_3$, $\Psi_4$ may be assigned the value O, and can therefore be considered as known.)

It is obvious that the integral $\int\dfrac{\partial\phi}{\partial s}ds$ taken right round any boundary must be zero, because the relative displacement of any point in relation to itself is of necessity zero.

This integral may also be written

$$\int\left(\frac{\partial\phi}{\partial x}dx + \frac{\partial\phi}{\partial y}dy\right)$$

and, remembering the relationships between $\phi$, $\psi$ and $\Psi$, we may also write

$$\int\left[\left(y + \frac{\partial\Psi}{\delta y}\right)\frac{dx}{ds} - \left(x + \frac{\partial\Psi}{\partial x}\right)\frac{dy}{ds}\right]ds$$

or

$$\int\frac{\partial\Psi}{\partial n}ds + \int pds$$

where $p$ is the perpendicular from the origin to a tangent to the boundary.

The first integral is easily expressed in terms of the boundary values of $\Psi$ by writing $\dfrac{\Psi_1 - \Psi_2}{t}$, etc., as the approximate value of $\dfrac{\partial\Psi}{\partial n}$, hence

$$\int\frac{\partial\Psi}{\partial n}ds = (\Psi_1 - \Psi_2)\int\frac{ds}{t} + \text{similar terms.}$$

The second integral is evidently twice the area enclosed by the contour, therefore the complete expression may be equated to zero thus :—

$$\Sigma\,(\Psi_1 - \Psi_2)\int\frac{ds}{t} + 2A_2 = 0 \;\ldots\ldots\ldots\ldots\ldots\ldots\; (B)$$

Each boundary gives us one equation of this form.

It would appear at first sight that $\Psi_1$, $\Psi_2$, $\Psi_3$, $\Psi_4$ can be determined from four equations such as (B). This is, of course, true, but, owing to the approximate nature of the solution to the problem, it is sufficient to put $\Psi_1$ the constant of the external boundary, equal to 0, and evaluate the other three constants from the equations corresponding to the internal boundaries.

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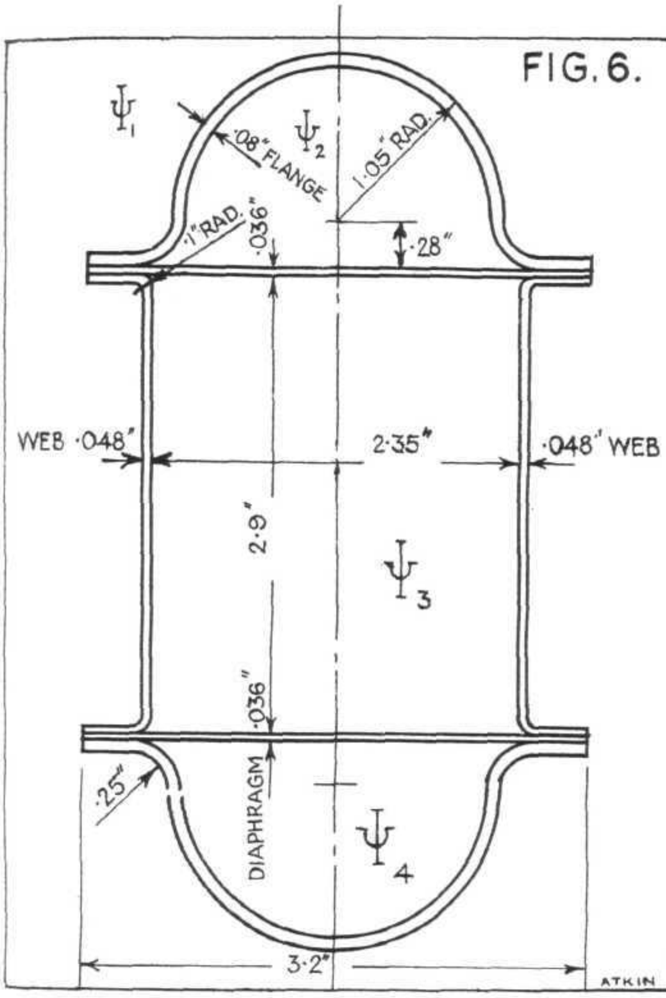
* Mr. Atkin is on the Technical Staff of A. V. Roe & Co. Ltd., at Manchester.

In order to obtain a consistent set of equations (B), the following sign convention should be observed.

$\frac{\partial \Psi}{\partial n}\left(\text{which we have seen has the approximate value } \frac{(\Psi_1 - \Psi_2)}{t}\right)$ is positive if $\Psi$ increases as we move outwards along a normal to the boundary considered.




To make the method of forming the equations quite clear, let us take as an example the spar section in Fig. 6. The various areas and lengths are indicated on the diagram.

By symmetry $\Psi_2 = \Psi_4$.

Hence, there are two equations (B),

$$\frac{3\cdot888}{0\cdot08}(\Psi_1 - \Psi_2) + (\Psi_3 - \Psi_2)\frac{2\cdot6}{0\cdot036} + 4\cdot134 = 0 \ldots \text{(i)}$$

$$\frac{2 \times 3\cdot014}{0\cdot048}(\Psi_1 - \Psi_3) + \frac{2 \times 2\cdot55}{0\cdot036}(\Psi_2 - \Psi_3) + 13\cdot66 = 0 \ldots \text{(ii)}$$

or, putting $\Psi_1 = 0$, and simplifying,

$$-120\cdot9\,\Psi_2 + 72\cdot3\,\Psi_3 + 4\cdot134 = 0$$
$$141\cdot7\,\Psi_2 - 267\cdot4\,\Psi_3 + 13\cdot66 = 0$$

and finally

$$\Psi_2 = 0\cdot0946$$
$$\Psi_3 = 0\cdot1012.$$

Equation (A) for the torque becomes

$$T = G\theta[2\Psi_3A_3 + 4\Psi_2A_2 - 2\Psi_1A_1 + \Psi_1A_{\Psi 1} + 2\Psi_2A_{\Psi 2} + \Psi_3A_{\Psi 3}]$$

so that $\theta$ can now be found in terms of $T_1$ and G.

Hence

$$\theta = \frac{T}{2\cdot29\,G} \text{ Rads. per in.}$$

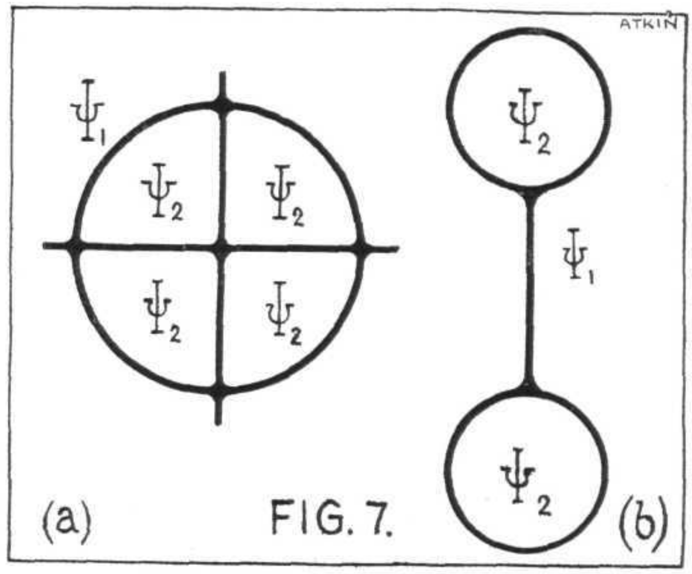
and stress in flanges $= G\theta \frac{(\Psi_1 - \Psi_2)}{t_{\text{flange}}} = 0\cdot516T$ lb./in.²

also, stress in webs $= G\theta \frac{(\Psi_1 - \Psi_3)}{t_{\text{web}}} = 0\cdot921T$ lb./in.²

and, stress in diaphragms $= G\theta \frac{(\Psi_2 - \Psi_3)}{t_{\text{diaphragm}}} = 0\cdot081T$ lb./in.²

T being the applied torque in lb. in.²

In many practical cases the section is symmetrical about one or more axes: it may then be possible to see by inspection, the relative values of the shears in some parts of the section, and to obtain an idea of the efficiency of a given type of section in torsion. Take, for instance, the series of sections in Fig. 7.




Section $(a)$ is seen to have equal values of $\Psi$ inside each of the inner boundaries so that there is no stress in the cruciform portion of the section. As the stiffness of a very narrow rectangle is negligible, this part of the section is, therefore, redundant.

Again, the single web spar $(b)$ is seen to be an inefficient section in torsion because $\Psi$ has the same value on both sides of the web, which is, therefore, ineffective.

This weakness of the single web spar is well known, and may be contrasted with the double-web spar of Fig. 6, which is much more efficient torsionally.

It was mentioned at the beginning that the value of the shear stress obtained by the method here described is only true when the thickness at any point of the section is small compared with the radius of curvature.

It is now proposed to outline the method of determining the maximum shear stress in a corner where the radius to thickness ratio is small.

Having analysed the section, and determined the mean shear stress, the following formula[6] may be used for single bends (no formula appears to exist for corners such as A, B, C, or D in Fig. 5).

$$f_{s\,\max.} = \frac{f_{s\,\text{mean}}\,1}{r_i} \cdot \frac{\left[1 - \frac{G\theta}{2\,f_{s\,\text{mean}}}(r_o + r_i)\right]}{\log_e \frac{r_o}{r_i}} + r_iG\theta$$

Where $r_o$ = outside radius of bend.
and $r_i$ = inside radius of bend.

Also, as before, $t$ = thickness of section wall.

In the case of the 0·1 in. radius in the web of Fig. 5, the maximum shear stress is 28 per cent. greater than the mean. This maximum occurs on the concave side of the bend.

In a sharp corner the stress is theoretically infinite, but *this does not necessarily indicate failure*. The importance of the concentration of stress in a corner of large or infinite curvature depends on the material of which the section is made. In the case of a ductile material such as mild steel the theoretical results may be of little value; but in the case of a very brittle material, a high theoretical value *for the shear stress concentration is a true indication that* failure will occur.

(6) *Strength of Materials*, Vol. 2, Timoschenko.

## LAUNCHING BY CATAPULT.

By Wing. Com. L. J. WACKETT, D.F.C., A.F.C., B.Sc.

*It is not often that we have the privilege of receiving contributions from aircraft designers in distant parts of the Empire, and it is therefore with all the greater pleasure that we publish in this month's* AIRCRAFT ENGINEER *an article by Wing Com. Wackett, who, as many of our readers will probably know, has for many years been Principal Technical Officer of the Royal Australian Air Force. Wing Com. Wackett deals with launching aircraft by means of catapults, and, as relatively few people at home have had occasion to go into this subject, his notes should be of interest.*—ED.

As it is possible to fly with a much greater loading per horsepower than it is possible to take off from the water, it seems probable that the launching of seaplanes by catapult will eventually become the standard method when working from ships or shore bases where catapult launching apparatus could be provided as standard equipment.

The greatest problem with commercial seaplanes is the problem of taking off heavily loaded, and it can be completely solved by launching by catapult.

Catapults have been adopted as standard equipment in the U.S. Navy, and more recently for mail carrying seaplanes on the Atlantic liners *Bremen* and *Europa*.

It was the study of two types of catapult on U.S. battleships which visited Sydney in 1926 that caused the author to decide to evolve some formula for general design of catapults, and the investigation of aircraft characteristics involved in catapult launching.

This paper consists of a description of two types of catapult used in the U.S. Navy in order to record the type of apparatus which is being used; and then a development of the general theory underlying their operation, and, lastly, a check calculation for the launch of two types of aircraft by the two types of catapult described. A note on acceleration and length of run is also given.

### The Compressed Air Type.

The first diagram (p. 79) illustrates the general arrangement. The "run" consists of a braced girder mounted so that it can be trained to point in any required direction by means of a pinion and circular rack. The launching rails form the top of a cantilever N-type braced girder, and mount a sliding carriage of duralumin, on which the aircraft is placed. The compressed air reservoir consists of a large tube mounted inside the girder and is charged, normally, with air at about 400 lb. per sq. in. from the ship's air supply. The air is expanded in a cylinder with a stroke of about 6 ft. and a reduction gear of 7 to 1 is arranged to give the carriage propulsion along the full length of the slide of 40 ft. The aircraft is held to the carriage by suitable fastenings which are arranged to release just before the sliding carriage reaches the end of the run. At the start, the carriage is retained by a trigger catch which releases when the pressure on the piston rises to 125 lb. per sq. in. The carriage moves forward slowly for about 2 ft. under this pressure until a slide valve opens and admits the full charge in the reservoir into the expansion cylinder. Acceleration is approximately constant, and an indicator diagram of the type shown is obtained.

The area of the diagram represents the work done in launching, and is equal to the kinetic energy imparted to the aircraft, plus the losses due to friction, plus the kinetic energy of the carriage. The latter is absorbed in a type of friction brake under air pressure control. This type of catapult is not suitable for aircraft of greater weight than 4,000 lb.

### The Powder Propelled Type.

This type is generally considerably larger and heavier and was mounted on the gun turret of U.S.S. *Mississippi*. This was necessary because of the size and weight. As before, there is a pair of slide rails and a carriage on which the aircraft is placed. The release gear is spring loaded and when the tension in the cable rises after the charge is fired, the spring load is overcome and the carriage is freed by a trip release.

The cable gear and expansion cylinder is similar to that used in the compressed air type. In place of a reservoir there is an explosion chamber with an arrangement similar to the breech of a 5-in. gun. A brass cartridge case is inserted and fired exactly as in a gun. The essential difference is that the vessel which takes the place of the gun chamber is very large in comparison, so that the maximum pressure rises to about 1·5 tons per sq. in., whereas in the 5-in. gun the pressure would be about 20 tons per sq. in. In gunnery terms, the "density of loading" is reduced to a low value to keep the initial pressure low and the initial volume of gas only slightly smaller than the final expanded volume. This results in a very uniform thrust on the piston and steady acceleration of the plane. As with the air catapult the piston finally overruns exhaust ports in the side of the cylinder and allows the gas to escape.

Oil filled energy absorbing cylinders, with pistons, are arranged to arrest the motion of the main piston, and the carriage, at the end of the run. The chief merit of powder as a propellant is the simplification of control and firing which is possible, and there is no practical limit in sight as regards the weight of aeroplane which may be launched.

### Dynamics of Aircraft Catapults.

The thrust required to accelerate the aircraft and the carriage to flying speed, and to overcome the resistance of the air, and the friction of the apparatus, is made up of two components, viz., the airscrew thrust and the catapult thrust and the latter is generally of the order of from five to 20 times the former. In the circumstances generally appertaining the airscrew thrust is only of secondary importance, but becomes of primary importance after the instant of release.

The resistance of the air depends on the attitude of the aircraft as placed on the carriage and varies as the square of the velocity. The attitude chosen would naturally be the attitude of least resistance which is not very different from the attitude of best climb.

The friction of the carriage varies as the combined weight of aircraft and carriage on the slide rails and for a well lubricated slide may be taken as independent of the velocity for the actual values of velocity attained.

Let $T_C$ = tension in the catapult cable

$T_E$ = Airscrew thrust, assumed constant, as its secondary importance does not justify the use of a varying relation.

$\mu W$ = Friction of slide, W = weight moved.

$Av^2$ = Air resistance of aircraft.

Then the equation of motion is :—

$$T_C + T_E - \mu W - Av^2 = \frac{W\,dv}{g\,dt} = \frac{W\,dx}{g\,df}\cdot\frac{dv}{dx} = \frac{W}{g}v\frac{dv}{dx}$$

Let $T_C + T_E - \mu W = B$, then $dx = \frac{W}{g}\,\frac{vdv}{B - Av^2} = \frac{W}{gA}\cdot\left(\frac{vdv}{\frac{B}{A} - v^2}\right)$

Let $\frac{B}{A} = C^2$, then $C = \sqrt{\frac{B}{A}}$ and $dx = \frac{W}{gA}\cdot\frac{vdv}{C^2 - v^2}$

Integrating $x = \frac{W}{gA}\int\frac{vdv}{c^2 - v^2} + K$, where K is a constant.

Performing the integration

$$x = \frac{W}{2gA}\left\{\int\frac{dv}{c-v} - \int\frac{dv}{c+v}\right\} + K$$

$$= \frac{W}{2gA}\left\{-\log(c - v) - \log(c + v)\right\} + K.$$

$$= -\frac{W}{2gA}\log(c - v)(c + v) + K.$$

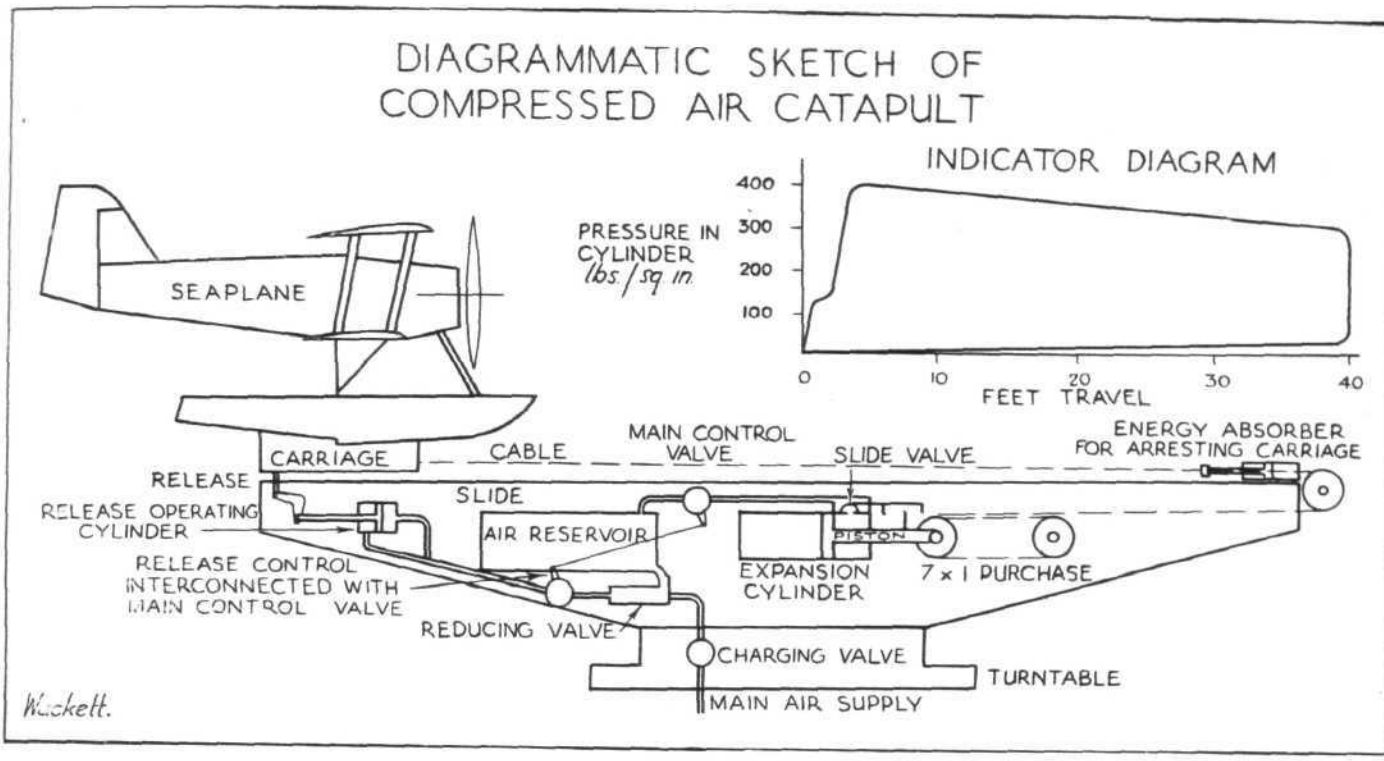
When $x = o$, *i.e.*, at the start, $v = o$ so that by substitution

$$K = \frac{W}{gA}\log c$$

So finally $\quad x = \frac{W}{gA}\cdot\log\frac{c}{\sqrt{(c - v)(c + v)}}$

from which $\frac{c}{\sqrt{(c - v)(c + v)}} = c^{\frac{xgA}{W}}$

and $\sqrt{(c - v)(c + v)} = \frac{c}{\frac{xgA}{W}}$, and $c^2 - v^2 = \frac{c^2}{e^{\frac{2xgA}{W}}}$




and $c^2 = v^2\left(\dfrac{1}{1 - e^{\frac{-2xgA}{W}}}\right)$, and remembering that $c^2 = \dfrac{B}{A}$

and $B = T_C + T_E - \mu W$

so by substitution $B = Av^2\left(\dfrac{1}{1 - e^{\frac{-2xgA}{W}}}\right)$ from which we get a formula for the necessary tension in the catapult cable.

$$T_c = Av^2\left(\frac{1}{1 - e^{\frac{-2xgA}{W}}}\right) - T_E + \mu W \quad \text{..................(1)}$$

**Expansion of the Compressed Air.**

Let the volume of the container be V, with air at an initial pressure P.

Let the volume of the expansion chamber be $V_1$ and the final pressure after expansion $P_1$.

Then for adiabatic expansion

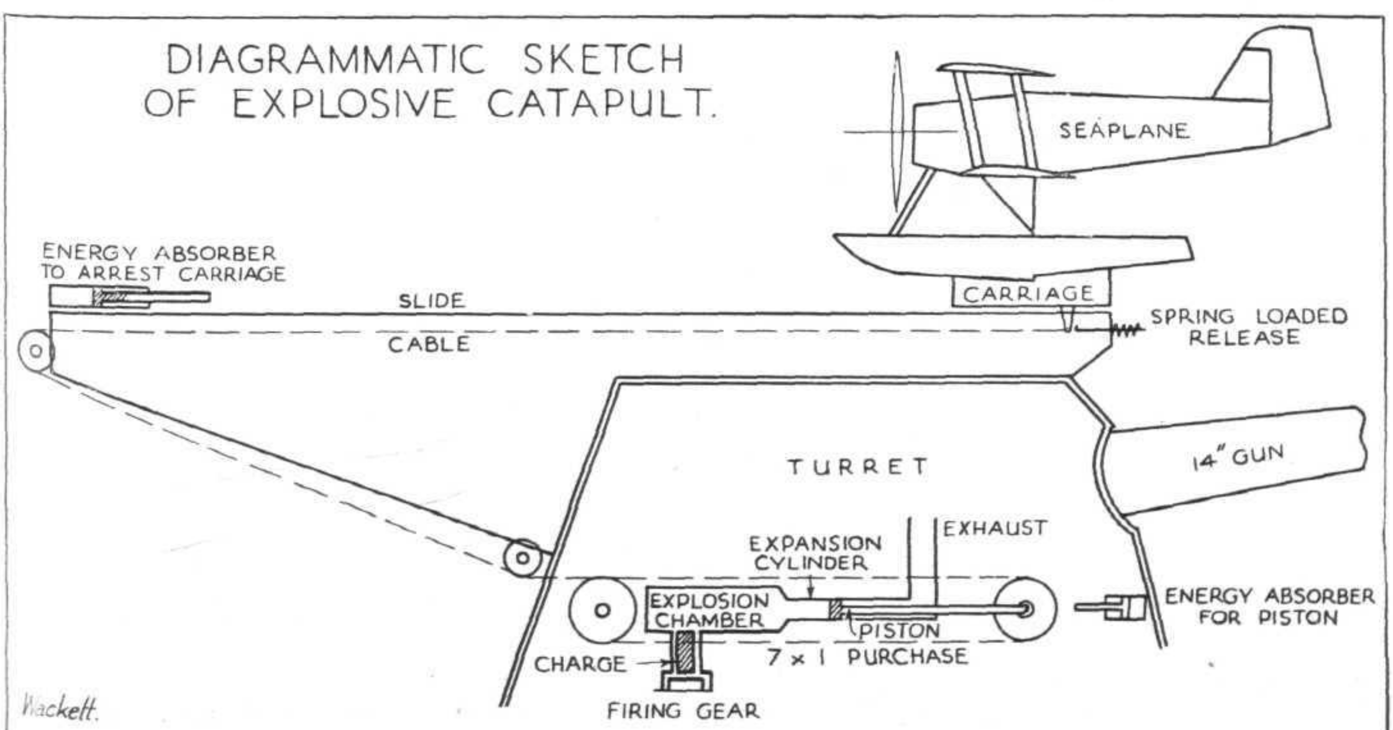
$$(PV^{\gamma}) = (P_1V_1^{\gamma}) \text{ where } \gamma = 1\cdot25$$

then $P_1 = P\left(\dfrac{V}{V_1}\right)^{\gamma}$

The average pressure will be the mean of the initial and final pressures $\dfrac{P + P_1}{2} = \bar{P}_A$. In order to get a short movement of the piston a 7 to 1 gear ratio is used so that the tension in the cable is $\dfrac{P_A \times A}{7}$ where A is the piston area.

An allowance of 10 per cent. is necessary to overcome friction in the cable and pulley gear and for the piston, so that $T_C = \dfrac{0\cdot9\, P_A \times A}{7} = 0\cdot128\, P_A A$ ..........................(2)

The conditions for a successful launch are obtained when equations (1) and (2) are combined.



### Interior Ballistics of a Powder Catapult.

If $c_1$ be the cubic capacity of the explosion chamber and $w$ the weight of the charge, then the expansion volume $v^1$ is, by definition, $\frac{c_1}{27 \cdot 73\, w}$.

Hadcock's empirical relation for the pressure and expansion volume for cordite or nitro powder in a closed vessel is :—

$P = 1 + \frac{107 \cdot 14}{V^{1 \cdot 28}}$ where P and V represent the initial pressure and volume.

These particulars are taken from the "Text Book of Gunnery."

As with the compressed air type the expansion is adiabatic and $PV^\gamma = P_1V_1{}^\gamma$

$P_A$ the average pressure $= \frac{P + P_1}{2}$ and the tension in the cable is as before $= 0 \cdot 128 P_A \times A$.

### The Launch of a Plane by the Compressed Air Catapult.

The aircraft is a "Vought" UO two-seater seaplane as used in the U.S. Navy and the leading particulars are :—

Weight of plane, 2,500 lb.
Weight of carriage, 200 lb. } weight launched 2,700 lb.
Length of run, 40 ft.
Total wing area, 276 sq. ft.
Lift coefficient at launching attitude $K_L = 0 \cdot 02$
$\frac{L}{D}$, *i.e.*, $\frac{\text{lift}}{\text{drag}}$ ratio, ,, ,, $\frac{L}{D} = 4 \cdot 78$
Minimum flying speed $=$ 80 ft. per sec.
Engine thrust $T_E$ for 220 h.p. ; $\eta$ = propeller efficiency $= 0 \cdot 65$ $= \frac{220 \times 550 \times 0 \cdot 65}{80} = 984$ lb.
Lift of wings at launching $L = K_L \rho A V^2$
$\rho = 0 \cdot 00238$ slugs, density at sea level, then $L = 835$ lb.
Air resistance at launching $= \frac{L}{L/D} = \frac{835}{4 \cdot 78} = 175$ lb.

Resistance constant $A = \frac{175}{v^2} = 0 \cdot 027$

Friction of slide $= \mu\, W = 0 \cdot 04 \times 2{,}700 = 107$ lb.
$\mu = 0 \cdot 04$ for metal surfaces well lubricated.

$$\text{Now } T_0 = Av^2 \frac{1}{\left(1 - e^{-\frac{2xgA}{W}}\right)} - T_E + \mu W$$

$$= 0 \cdot 027 \times 80^2 \left(\frac{1}{1 - e^{-\frac{2 \times 40 \times 32 \times 0 \cdot 027}{2{,}700}}}\right) - 984 + 107$$

$$= 5{,}393 \text{ lb. (tension in the cable)}$$

this is required to launch the aircraft. The initial pressure in the air container is 400 lb. per sq. in., and its capacity is 30 cu. ft. The expansion cylinder is 12 in. in diameter and 6 ft. long with a capacity of 4·75 cu. ft.

$$\text{The final pressure } P_1 = P\left(\frac{V}{V_1}\right)^{1 \cdot 25} = 400\left(\frac{30}{34 \cdot 75}\right)^{1 \cdot 25} = 332 \text{ lb./sq. in.}$$

$$\text{Average pressure} = \frac{P + P_1}{2} = \frac{400 + 332}{2} = 366 \text{ lb./sq. in.}$$

$$\text{Tension in the cable} = 0 \cdot 128\, P_A \times A = 0 \cdot 128 \times 366 \times \frac{\pi\, 12^2}{4} = 5{,}300 \text{ lb.}$$

This agrees fairly well with the tension required and shows that the method of calculation gives a close approximation to actual practice.

### Launch of a Large Monoplane by Powder Catapult.

The type of monoplane was known in the U.S. Navy as the "MO1" observation monoplane.

Weight of plane 4,800
,, carriage 500 } Launching weight, 5,300 lb.
Length of run, 50 ft.
Wing area, 400 sq. ft.

Attitude of wings give $\frac{L}{D} = 5$ and $K_L = 0 \cdot 35$ for this type,

so flying speed $= V = \sqrt{\frac{W}{K_L \rho A}} = 120$ ft. per sec.

Engine thrust $T_E$, $\eta = 0 \cdot 7 = \frac{(375 \text{ h.p.}) \times 550 \times 0 \cdot 7}{120} = 1{,}200$ lb.

(engine was 375 Curtiss 12-cylinder).

Aeroplane drag $= \frac{L}{L/D} = \frac{4{,}800}{5} = 960$ lb.

Friction $= \mu W = 0 \cdot 04 \times 5{,}300 = 212$ lb.

$$T_0 = Av^2 \left(\frac{1}{1 - e^{-\frac{2gxA}{W}}}\right) - T_E + \mu W$$

$$= 0 \cdot 027 \times 120^2 \left(\frac{1}{1 - e^{-\frac{2 \times 50 \times 32 \times 0 \cdot 027}{5{,}300}}}\right) - 1{,}200 + 212$$

$= 23{,}040$ lb., or $10 \cdot 3$ tons.

Now the charge used is the same as that used in a 5-in. naval gun, viz., 15 lb. of cordite. The explosion chamber is a cylinder 6 ft. long and 2 ft. in diameter, of capacity 32,600 cu. in., also, of the cubic capacity of the cartridge case in an adjoining cylinder 24 in. long and 5 in. diameter of capacity 470 cu. in. Total volume of explosion chamber = 33,070 cu. in. The expansion cylinder is 7 ft. long and 9 in. in diameter = 5,300 cu. in.

$$\text{Now the "expansion volume" } V = \frac{C}{27 \cdot 73W} = \frac{33{,}070}{27 \cdot 73 \times 15} = 80 \text{ units.}$$

$$\text{so } P = 1 + \frac{107 \cdot 14}{V^{1 \cdot 28}} = 1 \cdot 393 \text{ tons per sq. in.}$$

$$\text{Final pressure } P_1 = P\left(\frac{V}{V_1}\right)^\gamma = 1 \cdot 393\left(\frac{33{,}070}{38{,}370}\right)^{1 \cdot 25} = 1 \cdot 156 \text{ tons}$$

$$\text{Average pressure} = \frac{P + P_1}{2} = \frac{1 \cdot 393 + 1 \cdot 156}{2} = 1 \cdot 275 \text{ tons per sq. in.}$$

Area of piston = 64 sq. in, so tension in the cable $= T_0 = 0 \cdot 128\, P_A \times A = 0 \cdot 128 \times 1 \cdot 275 \times 64 = 10 \cdot 4$ tons.

which agrees well with the tension actually required.

These examples illustrate the procedure of arriving at the necessary particulars for designing.

### Length of Run and Acceleration.

For practical reasons, such as the effect of a large horizontal acceleration on the strength of the structure of an aeroplane, and the effect on the physique of the personnel, the maximum acceleration during a launch is limited to about 2·5 g.

The simplest type of expression connects acceleration, launching speed and length of run, $v^2 = 2fx$ and length of catapult $= \frac{v^2}{2f}$ where $v$ is the stalling speed.

There are many reasons which make 60 m.p.h. almost an arbitrary fixed value for stalling speed for commercial aircraft and the length of a catapult then becomes about 50 ft. independent of the size or weight or type of aircraft. It is possible to tabulate the initial pressures for compressed air, or the weight of powder charge for the launching of the range of aircraft weights within the capacity of the catapult. The remainder of the problem of catapult design then becomes one of structurel design and the design of control devices, release gear, energy shock absorbers for the ram and the carriage, and the mounting details.

# Air Transport

# The New Dornier Landplane

By EDWIN P. A. HEINZE

ALREADY, in the issue of October 9, FLIGHT was able to give some advance details of the new Dornier machine, the Do-K, which is at present undergoing its approbation tests. Owing to the kindness of the makers, which we duly acknowledge, the writer has received further interesting details of the machine, which give a good idea of the constructional features of the plane.

As our readers will recollect, the machine is an altogether new design, bearing no resemblance to the old Dornier "Merkur" landplane, which had a single engine and could convey six, or at most eight, passengers besides the crew of two. The Do-K has a streamline fuselage of oval section, with a cantilever type wing of entirely new form secured on top, and has ample cabin space for ten passengers. The idea of the designers was to create a fast passenger transport machine incorporating a high degree of safety for flying over country offering few possibilities of alighting in cases of emergency, such as the Alps and big deserts. For this reason high aerodynamical efficiency had to be secured, and the power plant had to be subdivided to as great an extent as was compatible with economical working. Four air-cooled Czecho-Slovakian Walter "Castor" engines of 240-h.p. output each were adopted and suspended in couples, one behind the other, beneath the wing right and left of the fuselage. The front engines have been provided with four-bladed wooden tractor screws and the rear with two-bladed pusher screws. With a full flying weight of 13,200 lb. this machine, during its trials, was able to attain a maximum speed of 137 m.p.h., the average touring speed being 125 m.p.h. and the ceiling 20,600 ft. With the same weight and one engine "dead," the machine was still able to rise to 12,800 ft., and with two engines stopped it climbed at the rate of 1.3 ft. per second at an altitude of over 3,200 ft. with the same flying weight.

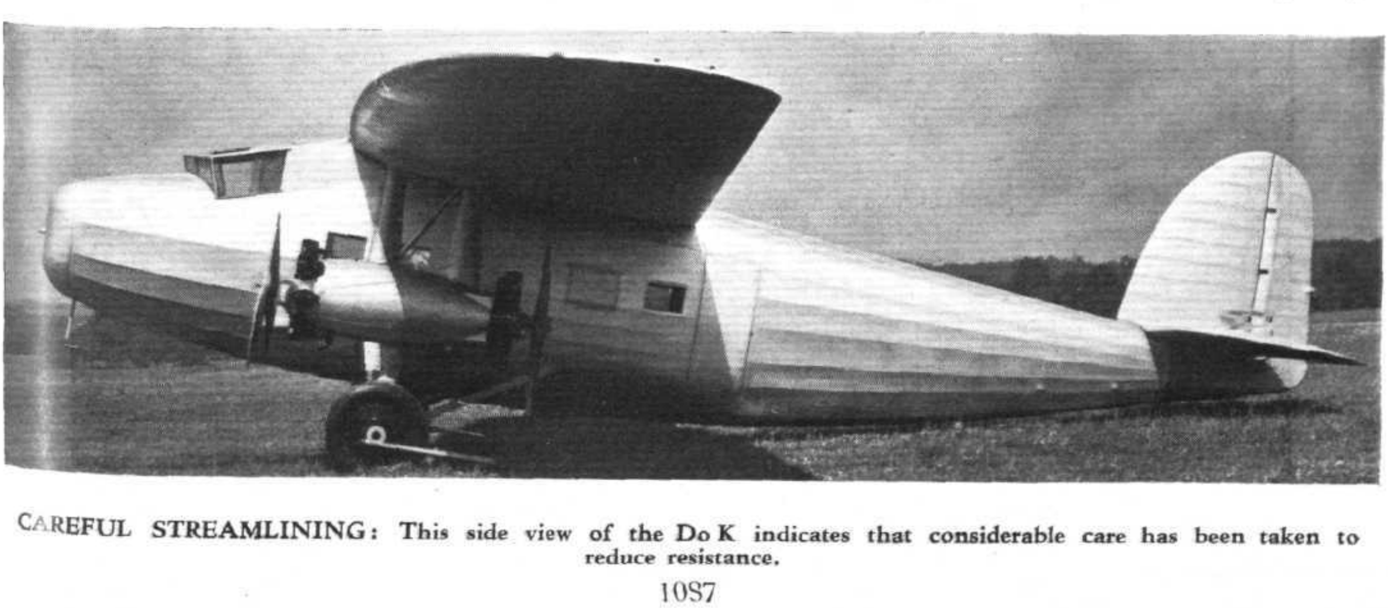
THE DO K IN FLIGHT: The projections behind the engines are the mudguards over the wheels.

The wing has a span of 82 ft., a maximum chord of 13 ft. 9 in., and a lifting area of 977 sq. ft. To secure low profile height (or wing thickness), which only amounts to $27\frac{1}{2}$ in., it was found advisable to employ three spars instead of the two usually adopted. In this Dr. Dornier has followed the practice that has already proved successful in the Do-X and the recently introduced Do-S, a flying boat with cabin space for 22 passengers, which is a successor of the famous "Superwal" type. The three spars consist each of a top and bottom rail of rolled duralumin of channel section. These rails are trussed by upright and diagonal channels riveted in place, the compression members of which are reduced in weight by a number of holes in the channel beds. The wing has a practically straight rear edge, to which the leading edge sweeps round, and it tapers in thickness towards the tips.

The spars are connected by fourteen main ribs, twelve auxiliary and a large number of forming ribs. The main ribs are constructed in a manner similar to the spars and, like the other ribs, of course, also are made of duralumin. They pass over the top and bottom surfaces of the spars, to which they are secured by short channel sections riveted on. The upright and diagonal bracings likewise consist of channels. The wing panels thus formed by the main ribs and spars are braced horizontally in two planes by crossed wires. The upper channels of the main ribs between the spars being straight, forming ribs of smaller and lighter duralumin channels are superimposed. The lower channels are slightly arched upwards between the spars and for this forming ribs, which give a plane lower surface, had likewise to be employed.

A number of auxiliary spars are formed by relatively small diameter tubes of oval section passing through the joints on the main and auxiliary ribs where the upright and diagonal web channels meet. Over these tubes slipped a number of small pressed plates. Joints are formed by three rivets placed equidistantly around the circumference, with a distance-piece between, and they serve to hold the top and bottom channels of the light forming ribs, which have no web structure of any kind.

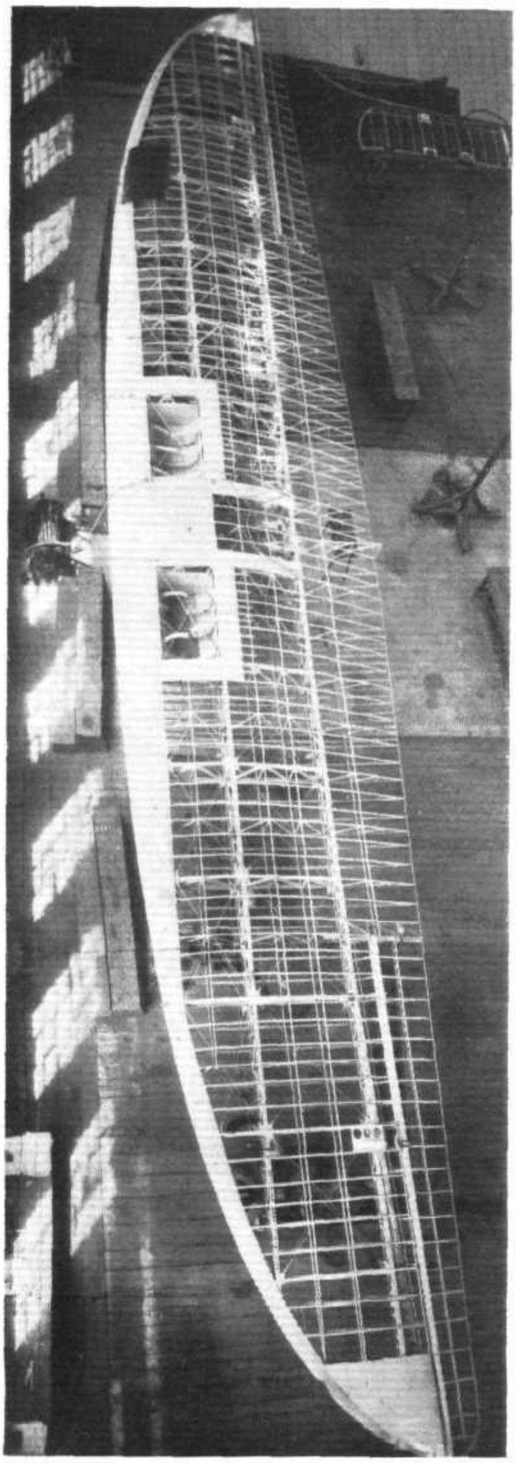
The leading edge of the wing is formed by shaped



CAREFUL STREAMLINING: This side view of the Do K indicates that considerable care has been taken to reduce resistance.

duralumin sheets, and the ailerons, which are constructed like the wing, are arranged in a cut-out in the trailing edge, of which their trailing edges form continuations to the tips. These are rounded and merge into the tip curves of the main wing. The upper and lower surfaces of the ailerons, when in their normal position, are flush with the wing and leave no slot between them and the latter. They are pivoted, however, on their lower sides some distance from their front edge on a number of brackets fixed on the rear spar of the wing. These brackets, when the ailerons are flush with the wing, cannot be seen, as they lie within corresponding recesses or slots in the ailerons, which are not balanced. Both the wing and the ailerons are fabric covered. The ailerons are operated by a rod coming out of the upper wing surface, and which is pivoted to a horn on top of the ailerons. Inside the wing and also for the operation of the tail plane, steel cables are employed in combination with the usual pulleys and bell cranks.

The wing is secured in the normal manner on the fuselage which, with a length of 52 ft. 2 in., has a main framework of steel tubes, around which is arranged a forming framework of duralumin hoops of channel section with flanges turned inwards. The hoops are joined by numerous stringers, also of channel section, which are secured to the hoops by one flange, while the other and outer flange is perforated for the attachment of the fabric covering. The steel tubes are flattened at the ends and slotted. Gusset plates are pressed into these slots, and screw bolts passing through the tubes and plates secure the joints. Only in some points of minor importance are rivets employed. In the cabin section of the fuselage the steel frame is braced with diagonal tubes. At the sides the outside forming frame comes close to the steel frame, but still the rather small windows in the outer frame are a few inches out from the steel frame, so, when the cabin equipment is complete, they appear inside recesses from the interior. In front of and to the rear of the cabin the steel frame is braced by wire.

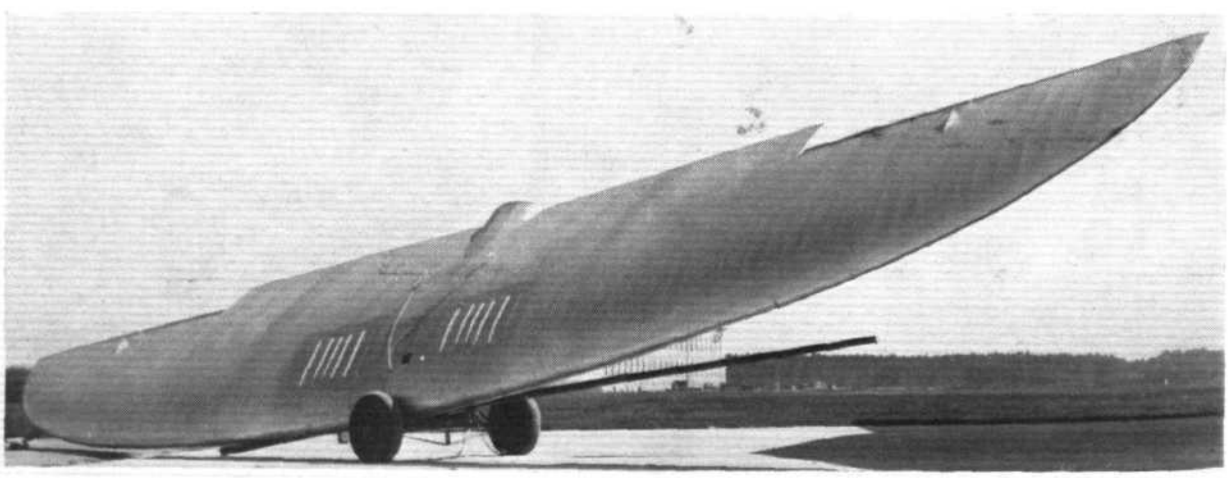


While the rear end of the fuselage tapers into a point flattened at the sides, the front end is formed by a large duralumin cap, which is hinged at the top, and, when open, gives access to a spacious luggage hold. Behind this follows the cockpit for the two pilots, whose seats are raised. This cabin is totally enclosed, and the roof superstructure of duralumin merges into the wing top. The roof sections over the pilot's seats slide in guides, and can be pushed back. Access to the cockpit is attained through the passenger cabin, to the rear of which is a lobby, with the entrance on the left and a lavatory on the right side, while behind this a further luggage or goods hold is to be found.

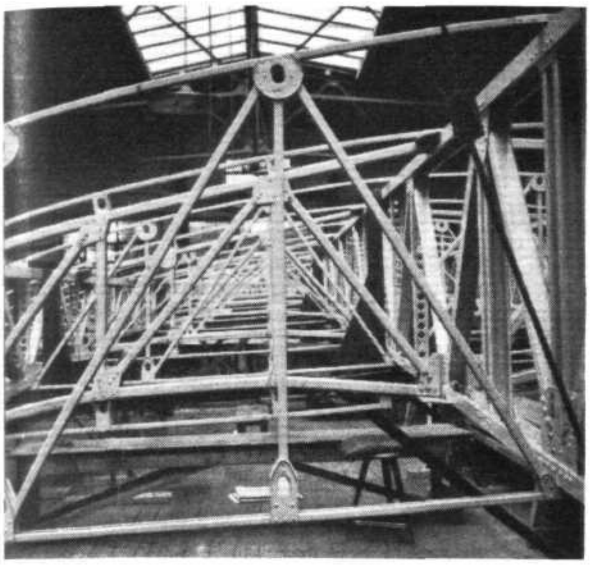
The tail, which is also fabric covered, is situated on top of the fuselage, with the rudder fin standing on the tailplane, which is braced with wires both against the fin and the fuselage. The rudder, extending down the rear edge of the fuselage, requires the elevator to be divided. The latter is balanced by the small typical Dornier compensating planes arranged a few inches above the tailplane.

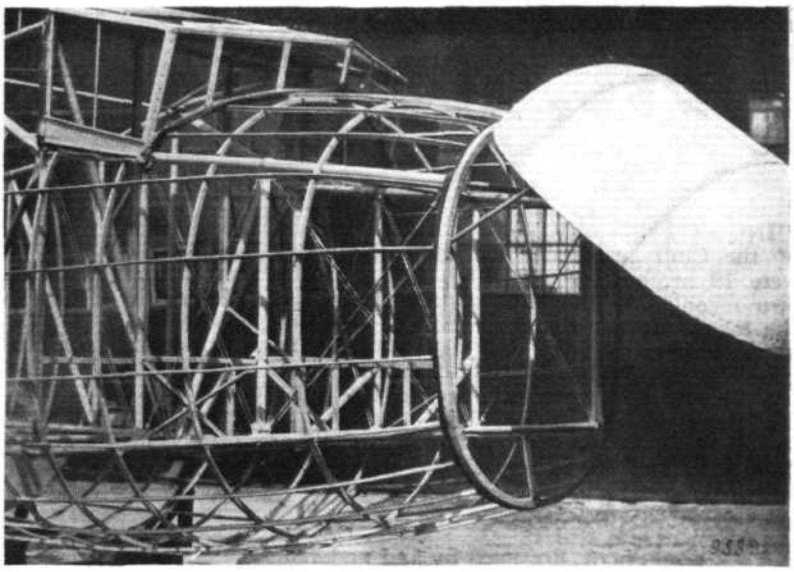
The engine nacelles are suspended each by two perpendicular faired struts from the wing. These two struts form a rectangular frame, of which the top beam is secured in a shallow recess in the lower wing surface, where two steel eyes are provided to attach it. A diagonal tension rod braces the struts and takes the propeller pull. Two almost horizontal struts connect each engine nacelle with the fuselage. Also with these a diagonal tension rod is used. The engine control rods are located inside the fairing of the upright struts.

The landing wheels are mounted



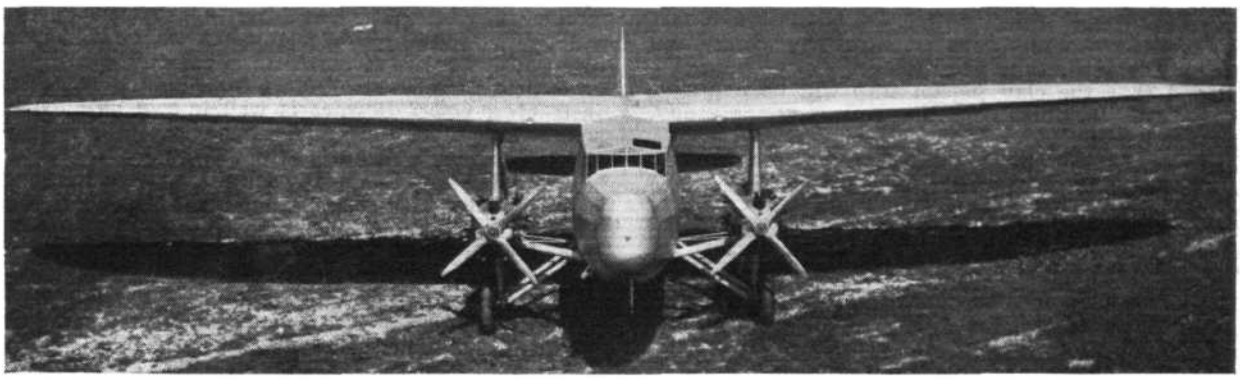
**THE DO K WING IN SKELETON: The wing is a three-spar structure, the spars being girders built up of channel sections. In the lower view is shown the wing after covering.**





**THE STRUCTURE: On the left an end view of a wing, and on the right the skeleton of the front portion of the fuselage. The main fuselage structure is of steel tube.**

on the apex of two struts, each arranged to form a triangle with the fuselage, on which they are hinged. The spring legs are attached to the bottom of the engine nacelles and incorporate Rheinmetall (Faudi) pneumatic shock absorbers. The wheels are furnished with long mudguards extending at the rear. For the tail support a skid is employed.



**FRONT VIEW OF DO K: The engine and undercarriage strutting is simple and apparently robust.**

#### Air Mail Traffic

During the quarter ended September 30, 1931, 34,061 lb. of letter air mails were carried from this country as compared with 26,248 lb. during the corresponding quarter of 1930, an increase of 29 per cent. The carryings to India were 8,746 lb. as compared with 7,712 lb. in the September quarter of 1930, an increase of 13 per cent.

The traffic to various destinations was as follows:—

| | September quarter, 1930 lb. | 1931. lb. |
|---|---|---|
| Indian Air Service (including Egypt, Iraq, Palestine, etc.) | 11,547 | 12,493 |
| Central African Service ... | — | 1,625 |
| Australian Internal Service... | 1,402 | 1,185 |
| South African Internal Service ... ... ... ... | 2,076 | 2,354 |
| Other extra-European destinations ... ... ... | 1,500 | 2,059 |
| Total extra-European Services ... ... ... | 16,525 | 19,716 |
| Continental Air Services ... | 9,723 | 14,345 |
| Grand Total ... | 26,248 | 34,061 |

The traffic for European countries showed an increase of 47 per cent. over the September quarter, 1930. There was a decrease of about 10 per cent. in the amount of parcels carried by air to European destinations, the figures being 36,924 lb. in the September quarter, 1931, as compared with 41,460 in the corresponding quarter of 1930.

#### Winter Service to Brussels, Antwerp and Cologne

In conjunction with the Belgian S.A.B.E.N.A. Company, Imperial Airways will operate daily (except Sundays) winter air services to Brussels, Antwerp and Cologne, with connections via the German air lines to Düsseldorf and Essen. The reduced winter air fare to both Brussels and Antwerp is £3 10s. as compared with the previous £4, while that to Cologne is £5, this comparing with the previous fare of £5 10s.

#### Australia-England Mail Flight

Australian National Airways are arranging, in conjunction with the British and Australian postal departments, a special air mail flight from Australia to England and back. Their 3-engined Avro, *Southern Sun*, piloted by Mr. G. V. Allen, is to leave Hobart on November 19 and will proceed from Melbourne on November 20. Following the usual route via Sydney, Brisbane, Camooweal, Wyndham, Rangoon and Allahabad, the machine is due in London on December 3. The return mail from London is due in Hobart on December 24. Passengers will also be carried if any requests for the trip are made.

#### New Pacific Coast Air Services

Two important new air services are reported from the Pacific Coast. The Coastal Airways, Ltd., will carry air mail daily between Vancouver and Victoria, B.C., and a twice-a-day passenger service between Victoria and Seattle, U.S.A., will be operated by the Royal Air Line, controlled by Coastal Airways, Ltd.

#### A Denmark-America Service?

It is reported that a regular air service between Denmark and the United States is to start next summer, according to the manager of the Norwegian Air Line.

# Private Flying & Club News

CINQUE PORTS FLYING CLUB.—The hours flown by the Club aeroplanes for the week ended October 17 were 19 hr. and 30 min. Lt. Com. Gubbins flew in his own machine to the Midlands on October 10. Owing to the foggy weather round London he was unable to return until October 14. On that day also Mr. Law arrived in his Westland Widgeon III, G-EBRN. Lt. Com. Gubbins has become hon. secretary to the Club, in succession to Mr. Drake, who has resigned owing to taking up an appointment in the Far East. The Club are deeply indebted to Mr. Drake for all the work he has done, and wish him success in his new appointment.

HANWORTH CLUB.—A special Demonstration Clay Pigeon Shoot, arranged by and under the Rules of the Clay Pigeon Shooting Association, will be held at the London Air Park on Wednesday, November 4. The programme will be:—12 noon, practice. Event No. 1—1.0 o'clock: 25 Bird Special Demonstration Shoot by Britain's leading clay pigeon shots, including the 1931 British Champion and International Team Captain, Mr. C. Lucas. Event No. 2: 10 Bird "Tyros" Competition, restricted to those who have never won a prize at a clay pigeon shooting meeting. Entrance fee, 1s. 6d. Special prize open to members of N.F.S. Clubs. Event No. 3: 5 Pairs Double Rise—Scratch. Entrance fee, 2s. 6d. Three prizes for each event. Competitions at Crossing Birds and Handicap by Distance, time permitting.

It is hoped that the clay pigeon trap will be available for the use of members on the following Saturday, November 7.

As noted elsewhere in this issue, arrangements have been made for the Focke Wulf Ente (the "Tail First Machine") to be demonstrated at Hanworth.

The dates provisionally arranged for this demonstration are from Friday, October 30, to Monday, November 2.

AT BROOKLANDS.—Flying at Brooklands is not showing the statistical decline which has hitherto been a melancholy feature of aviation in winter. The Sales Department has sold three machines for immediate delivery and two for delivery in January. The Repairs Department has been working overtime, and turned out five machines in the week, which is two above the summer average. On the instructional side the "dawn patrol" referred to in last week's notes, together with the 20 per cent. bonus on winter flying rates, continues to maintain activities. In spite of mist, 44 hours of flying were carried out, and six new pupils joined the School, including two ladies. Mr. Holbeach made a successful first solo, and Messrs. Vaughan and Piper obtained their "A" Licences. The Blind Flying Course is also going to prove a popular feature, and 25 pupils are already down for tuition.

THE PHILLIPS AND POWIS School of Flying held a dance at their clubhouse on Woodley Aerodrome last Saturday night, October 24. This proved an even greater success than had been expected. The new wireless installation was particularly valuable as it provided excellent music without taking up any space on the floor, a virtue not possessed by musicians who are actually present in the flesh. Nearly a hundred guests attended, but owing to the arrangements the club at no time appeared overcrowded. It was altogether a most enjoyable evening, and those responsible are to be congratulated.

THE NEW YORKSHIRE COUNTY AVIATION CLUB.—Sherburn-in-Elmet is now the headquarters of the new Yorkshire County Aviation Club.

Formed only some three weeks ago, this venture shows much promise, and it is worthy of success if only for saving Sherburn aerodrome from returning to agricultural land, and every pilot flying north will agree that it is far too good and useful a landing ground to be lost.

The owner of the land is Mr. Harry Hey, well known to pageant visitors, and the hangars and clubhouse belong to the firm of Burnetts, the railway wagon builders. These two have generously given the new club an excellent start by refusing to accept any rent whatsoever for the first twelve months. The Blackburn Aeroplane Co. are providing two or three specially streamlined "Bluebirds," and Capt. Downer of that firm is taking up residence there as full-time instructor. Apart from his qualifications as an instructor, Capt. Downer is well known as a particularly sound navigator, and will be remembered as navigator for Capt. Courtney's Atlantic attempt.

The new club has already enrolled over a hundred members, including many well-known members of the original Yorkshire Aeroplane Club, who will find Sherburn a useful second string to Yeadon. Mr. Arthur Senior, of "Hayfield," Shadwell, near Leeds, is the Hon. Sec., Col. Emsley, a prominent North Country polo player, is chairman of the committee, and any visiting pilot may be assured of a true Yorkshire welcome.

BRISTOL AND WESSEX AEROPLANE CLUB.—One of the snags of the new Bristol Airport so frequently quoted is that of inaccessibility owing to the tortuous nature of the approaching roads. We are glad to hear that the new arterial road linking the north part of the Aerodrome with the town is making good progress. The finish of this should further the aims of the Airport Committee, namely the establishment of manufacturers and other works around it, for naturally manufacturers cannot be expected to consider the site until the transport of their goods by means of heavy lorries is a convenient and easy matter. The road is expected to be opened early next year.

FAIRING A "MOTH."—Mr. Ralph Kenyon, of Newtonville, Mass., U.S.A., writing to the de Havilland Co., claims marked improvements in the performance of an English "Moth" he has streamlined-up. Having built a false bottom to the fuselage, and faired all strut fittings, all landing gear fittings, the petrol tank into the wings, the wings into the fuselage, the headrest into the fin, bridged the gaps in the ailerons, elevators and rudder, and constructed a detachable front cockpit cover and windshield, he has obtained a top speed of 134 m.p.h. and a cruising speed of 120 m.p.h. The take-off and stalling speeds, he says, were not noticeably impaired, but the gliding ratio was increased. The accompanying illustration shows an American "Moth" thus treated.

The hangar maintained by Airwork, Ltd., at Bristol, has been very busy during the past month, having had in hand a repair job, two renewals for C. of A., and a lot of local work. Mr. Norman Edgar, who has taken over the Airport Showroom, is doing very good business. He makes a point of arranging that no matter what type of machine, new or secondhand he has an inquiry for, he will see that it can be demonstrated at Bristol. One of the most interesting machines he has had on offer during the past month is the Parnall "Elf." This has been greatly improved, and, as we told our readers recently, is now a delightful machine to fly, and is particularly well and strongly built.

Mr. Cliff, who runs the air taxi depôt of Phillips & Powis, Ltd., has also been very busy both with his Desoutter and Spartan, the Cardiff pageant in particular providing him with a lot of work, and he made the trip to Splott Aerodrome many times.

THE LANCASHIRE AERO CLUB.—There has been a lot of criticism lately about the state of the roads approaching Woodford Aerodrome and the Aerodrome surface itself. The critics will, however, shortly have nothing to criticise since work for dealing with these is in hand. The Aerodrome is being hunterised by Hunters, of Chester, for A. V. Roe & Co., Ltd., and before long it is expected that members will be playing billiards on its surface instead of taxying aircraft. November 11, Armistice Day, will be celebrated by holding a Dinner at the club. Those desiring to attend are asked to procure their tickets in advance (price 7s. 6d.) from the Secretary or Steward, or any member of the Committee. Dinner jackets and decorations will be worn. Mr. Alan Goodfellow, who has recently retired from the Committee after six years' service, will be the guest of the evening.

The flying time for the nine months ending September was 1,131 hr. 25 min., as against 1,234 hr. 45 min. for the corresponding period last year. This does not unfortunately maintain the annual increase, but in view of the acute industrial depression in the north country, these figures must be considered as good.

Mr. R. F. Hall has been appointed Voluntary Assistant Instructor of the club.

THE SCOTTISH FLYING CLUB put in 147 hr. 50 min. for the month of September, while the flying time for the period of ten months ending September, 1931, was 1,097 hr. 20 min., as compared to 1,246 hr. 40 min. in 1930. It should be noted that the club's telephone numbers have recently been altered and are now Renfrew 191 and 192. It has been pointed out that many members do not seem to realise that telephone numbers form a short and therefore cheap method of addressing telegrams; a telegram therefore addressed to Renfrew 191 will reach the Scottish Flying Club and have the added advantage of being telephoned from the Post Office, thus in all probability arriving quicker than were it entrusted to a boy on a bicycle.

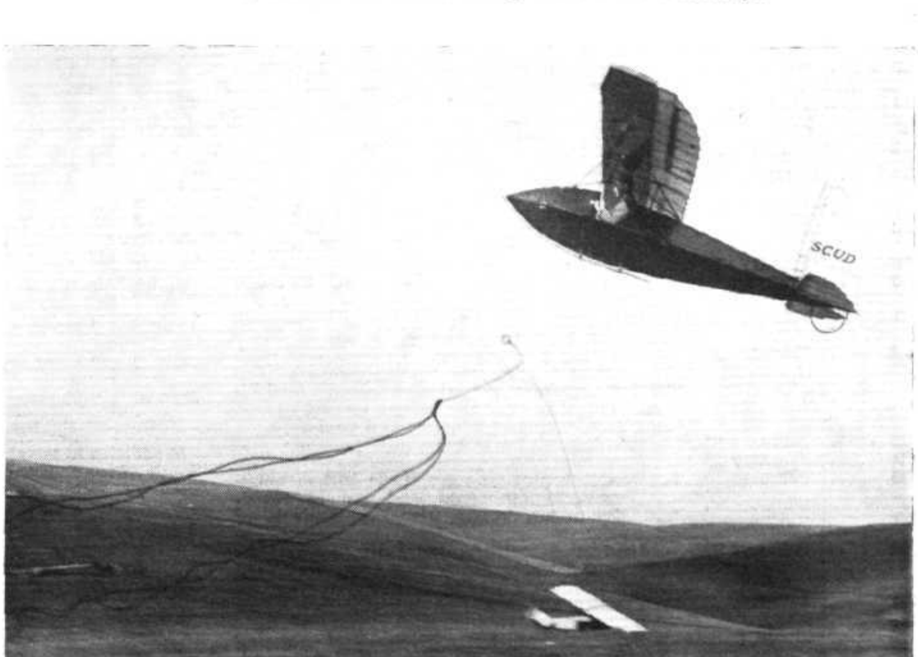
The ground classes which were so successfully held last winter will be continued on Wednesdays at 8 p.m., starting from November 4. The complete course will be £2 2s., and the Chief Instructor will be glad to receive the names of intending pupils. Members and others should note that the club is open again for flying on Mondays.

# GLIDING

AN INTERESTING GLIDING LECTURE.—On October 22, Herr Bedau, of the Deutscher Luftfahrt Verband and the Berlin Gliding Club, delivered a very interesting lecture before the British Gliding Association in the library of the Royal Aeronautical Society. Herr Bedau was the fortunate recipient of a free trip given by the Norddeutsche Lloyd in the liner *Bremen* from Bremen to Southampton and back, which he received as a prize for a duration flight of 7½ hr. and an altitude flight of 5,000 in the 1930 gliding competitions at the Wasserkuppe.

Herr Bedau said that his lecture was somewhat scrappy, as his decision to visit England was made very suddenly, and he had not had therefore sufficient time to prepare a proper lecture. He showed a very interesting series of slides illustrating all types of gliders, starting with models and working up through many and varied forms of gliders and sailplanes to such machines as the "Luftikus," "Musterle," "Fafnir," "Austria" and the "Fliege," a machine which Herr Bedau himself designed and which was flying in the Rhön during the competitions this year. This particular machine only weighs 100 kg. and has a span of 10 m.

After the slides the lecturer expressed his hope that the gliding movement in England would continue to flourish and that he would have the pleasure of seeing many of his audience in future competitions in Germany.




**WELL UP: The little Scud caused a lot of enthusiasm for British built gliders at the recent International Glider Meeting at Balsdean. F./O. Mole made several excellent flights on it and E. D. Abott, Ltd., of Farnham, the builders, together with Mr. L. E. Baynes, the designer, will we trust reap the benefit of their enterprise.**

**New York-Constantinople Record Recognised**

THE New York-Constantinople flight of Russell Boardman and John Polando, made on July 28 to 30, has been recognised as a world's record for a direct line flight by the International Aeronautical Federation. The distance is given as 8,065 kilometres .736 (5,040 miles).

**Records Homologated**

THE Royal Aero Club has received notification from the Fédération Aéronautique Internationale of the homologation of the following Records:—

*World's Record.*—Greatest Speed (Great Britain): Flt. Lt. G. H. Stainforth, A.F.C., September 29, 1931, on Supermarine Rolls Royce S.6B, at Lee-on-Solent, 655 kilometres per hr.

*International Record.*—Great Speed over 100 Kilometres: Flt. Lt. J. N. Boothman, A.F.C., September 13, 1931, on Supermarine Rolls Royce S.6B, at Spithead, 551 kilometres .880 per hr.

**French Seaplane's 348 m.p.h.**

DURING a test flight at Berre on the 1,860-h.p. seaplane originally intended for the Schneider Contest, Jean Assolant is reported to have attained a speed of 348 m.p.h.

# SOME FORTHCOMING LECTURES

## AIR NAVIGATION LECTURES—WINTER SESSION, 1931–2

THE undermentioned course of lectures in air navigation has been arranged by the Guild of Air Pilots and Air Navigators of the British Empire, who prepare candidates for the Air Ministry second-class air navigators' licence. The lectures will be held at Gwydyr House, Whitehall, S.W.1, every Tuesday and Friday, from 6 to 7.30 p.m., and the fee for the full course of 35 lectures will be £5 5s. If sufficient candidates signify their intention of attending, then a series of lectures for the first-class air navigator's licence will also be arranged at a fee of £10 10s., providing a minimum of five pupils is forthcoming. The Warden of the Guild, 61, Cheapside, London, E.C.2, will be glad to receive early application from anyone who desires to take either of the courses, and all cheques should be sent to Capt. A. G. Lamplugh, Lloyd's Building, Lime Street, E.C.3.

SYNOPSIS OF LECTURES

| Lecture No. | Approximate Date. | Subject. |
|---|---|---|
| | 1931 | |
| 1 | November 10 | Logarithms. Principle of logarithmic calculations. Construction of tables. Calculations by means of logarithms. |
| 2 | November 13 | The slide rule, principle of construction. Simple calculations. |
| 3 | November 17 | Plane trigonometry. Elements of the trigonometrical ratios. |
| 4 | November 20 | The traverse tables. Construction and uses. |
| 5 | November 24 | Meteorology. |
| 6 | November 27 | Form of the earth definitions. |
| 7 | December 1 | Middle latitude and parallel sailing. Calculation of courses and distances. |
| 8 | December 4 | Time. Change of time with longitude. Rising and setting of the sun and moon. |
| 9 | December 8 | The nautical almanac. G.M.T., L.M.T., and L.S.T. Zone time. |
| 10 | December 11 | Map projections. Principles of construction of the mercator, gnomonic, and conical projections. |
| 11 | December 15 | Meteorology. |
| | 1932 | |
| 12 | January 5 | Properties of the various forms of projections in common use. Precautions required. |
| 13 | January 8 | Units of distances and angles. Conventional signs and abbreviations. Map scales. |
| 14 | January 12 | Methods of indicating height. Map reading, technical topographical terms. Sexagesimal and centesimal systems. |
| 15 | January 15 | Meteorology. |
| 16 | January 19 | Mercatorial sailing. Calculation of courses and distances. |
| 17 | January 22 | Elementary magnetism. Earth's magnetism. |
| 18 | January 26 | Variation, dip, horizontal and vertical components of the earth's total force. Definitions. |
| 19 | January 29 | Meteorology. |
| 20 | February 2 | Aircraft compasses. Construction. Care and maintenance. |
| 21 | February 5 | Deviation. Causes and effects. The approximate coefficients A, B, C, D, and E. |
| 22 | February 9 | Methods of determining deviation with compass bases and landing compass. Use of amplitude and azimuth tables. Analysis of deviation. Northerly turning error. Acceleration and deceleration errors. |
| 23 | February 12 | Practical work with a model. |
| 24 | February 16 | Meteorology. |
| 25 | February 19 | Dead reckoning. Course, track, drift, measurement of air speed and ground speed. Definitions, vector triangles. Methods of solution. |
| 26 | February 23 | Navigation instruments. Drift indicator. Course and distance computer. Air speed indicator. Altimeter. Turn indicator. |
| 27 | February 26 | Practical problems. Chart work. |
| 28 | March 1 | Meteorology. |
| 29 | March 4 | D.F. W/T systems. Bellino Tosi, rotating beacon, equi-signal beacon, and wing coil. Comparative merits. |
| 30 | March 8 | Night effect, Adcock aerial. Coastal refraction. Quadrantal error. Use of W/T bearings in navigation. Convergency of meridians, conversion angle. Practical problems involving laying off bearings on different projections. |
| 31 | March 11 | Meteorology. |
| 32 | March 15 | Air legislation. The Convention. The Air Navigation Act, Accident Regulations, Orders and Directions. |
| 33 | March 18 | Books of reference, *e.g.*, "Air Pilot," "Admiralty Sailing Directions," "Tide Tables," etc. Air and marine lights, rules of the air, rules at sea, signals. Buoyage systems. |
| 34 | March 22 | Meteorology. |
| 35 | March 25 | Final revision. |

**NOTE.—In addition to the lectures outlined above, practice will be given throughout the course, as far as time permits, in visual signalling, semaphore, flashing, and procedure.**

## WESTLAND AIRCRAFT SOCIETY

### ANNUAL GENERAL MEETING.

THE Annual General Meeting of the Westland Aircraft Society was held at Yeovil on Thursday, October 15, when the report for the past session was presented from which it is interesting to note that 21 lectures were delivered before this Branch of the Royal Aeronautical Society during Session 1930-31.

Further activities of this society comprised visits to works, etc., and the showing of films having an engineering interest.

With a membership of approximately 300, it is apparent that there is a growing interest in aeronautical science, and as the membership subscription is only 5*s*. per annum, it is easy to understand the popularity of this society.

Capt. Keep, a director of Petters, Ltd., was in the chair, and referred in his opening remarks to the progressive policy of the society, and called attention to the very interesting programme of lectures which has been arranged for the coming session.

The officers and committee appointed for the coming session are as follows:

President: R. A. Bruce, Esq., O.B.E., M.Sc., M.Inst.C.E., M.I.M.E., F.R.Ae.S., managing director Westland Aircraft Works. Hon. Sec.: Mr. V. S. Gaunt, A.M.I.Ae.E. Hon. Treas.: Mr. J. Johnston, A.F.R.Ae.S. Hon. Asst. Sec.: Mr. H. J. Penrose, A.F.R.Ae.S.; whilst the new committee comprises Capt. A. S. Keep, M.C., B.Sc., A.F.R.Ae.S., and Messrs. Byron, Gibson, Russell, Rowan and Holroyd.

The hon. sec. in making his report thanked Petters, Ltd., for certain facilities granted to the society, and also the president and vice-presidents, particularly Mr. Cole, the proprietor of the Three Choughs Hotel, who so kindly allowed them the use of his commercial room for the lectures which take place at approximately weekly intervals from October until March.

Applications for membership and renewal of subscriptions should be sent to the hon. secretary of the society, c/o Westland Aircraft Works, Yeovil.

**Syllabus of Lectures, 1931-32.**

| Date. | Description. | Lecturer. |
|---|---|---|
| Oct. 29 | "The Petter Atomic Diesel Engine." | Mr. H. Sammons, Chief Engineer, Petters, Ltd. |
| Nov. 5 | "Plating Processes" | Mr. W. Merry, Asst. Chief Chemist, W. Canning & Co., Ltd. |
| Nov. 19 | "Model Aircraft" | (To be confirmed.) |
| Nov. 26 | "The use of Magnesium Alloy and Elektron on Aircraft" | Mr. E. Voss, Production Engineer, Westland Aircraft Works. |
| Dec. 4 | "Air Photography, its Developments and Applications" | Flt. Lt. A. J. Elliott. |
| Dec. 10 | "The Gliding Movement in England and Germany" | J. R. Ashwell-Cooke, Esq., Chairman of the London Gliding Club. |
| Dec. 17 | "Commercial Aviation" | Capt. G. P. Olley, of Imperial Airways. |
| | CHRISTMAS INTERVAL. | |
| Jan. 7 | "Ten Years' Progress in Aeronautics" | Capt. J. Laurence Pritchard. |
| Jan. 9 | Visit to Marconi Wireless Station, Dorchester | — |
| Jan. 14 | "Rolls-Royce Aero Engines." | (To be confirmed.) |
| Jan. 21 | "My Visit to South America" | Mr. H. J. Penrose |
| Jan. 28 | "The Autogiro" | Senor J. de la Cierva. |
| Feb. 4 | "Engine Maintenance" | Mr. Hodgson, A.I.D. |
| Feb. 11 | "What Model Tests Teach Us" | Mr. W. Widgery. In charge of Wind Channel, Westland Aircraft Works. |
| Feb. 18 | "Further Developments in Aircraft Instruments" | Major C. J. Stewart, O.B.E., R.A.F. |
| Feb. 25 | "My Visit to Lake Kivu and Back" | Sir Alan Cobham, K.B.E., A.F.C. |
| Mar. 3 | "Light Alloys for Aircraft" | Mr. W. H. Craven. Aluminium II, Ltd. |
| Mar. 10 | "The Wapiti in England" | Flt. Lt. E. A. Healy, R.A.F. |

In addition to the above we are endeavouring to arrange for "The Wapiti in South Africa." By an Officer of the South African Air Force.

### Hull and Leeds Branch, R.Ae.S.

WE give below the lecture programme for the 1931-32 session of the Hull and Leeds Branch of the Royal Aeronautical Society:—

1931.

Nov. 20 .. "Speed in Aviation and what it means," by Lt. Col. W. Lockwood Marsh, O.B.E., M.A., LL.B., F.R.Ae.S.

Dec. 11 .. "Tests of Aircraft Structures and Components," by Mr. I. J. Gerard, M.Sc., Assoc. M.Inst.C.E., A.F.R.Ae.S., of The Royal Aircraft Establishment, Farnborough.

1932.

Jan. 8 .. "The Progress and Prospects of Civil Aviation," by Major R. H. S. Mealing, Chief Technical Assistant, Directorate of Civil Aviation.

Feb. 12 .. "The Work of the Armament and Aeroplane Experimental Establishment at Martlesham Heath," by Sqd. Ldr. H. W. McKenna, D.C.M., Chief Engineer, A.A.E.E., Martlesham Heath.

March 12 .. "Problems connected with the Development of High Speed Oil Engines," by Mr. C. B. Dicksee, A.M.I.Mech.E., M.I.A.E., of the Associated Equipment Co., Ltd.
Joint Meeting with the "Hull Association of Engineers" held in the Hull Municipal Technical College.

(All other Meetings are held in the University College, Hull.)

# THE ROYAL AIR FORCE

*London Gazette*, October 20, 1931

*General Duties Branch*

The following are granted short service commns. as Pilot Officers on probation with effect from and with seny. of dates stated:—R. C. Reynell (Pilot Officer, R.A.F.O.) (Sept. 28); R. H. Maw (Flight Lieutenant, Special Reserve) (Oct. 1). Flight Cadet F. C. Daubney, having successfully passed through the Royal Air Force College, Cranwell, is granted a permanent commn. as Pilot Officer on probation with effect from Sept. 1, and with seny. of July 25; Lt. D. W. Mackendrick, R.N., is re-attached to R.A.F. as Flying Officer with effect from Oct. 10, and with seny. of Sept. 1, 1926.

The following Pilot Officers on probation are confirmed in rank:—G. W. P. Grant, P. J. W. Hawkins, D. W. Morrish (Sept. 22); G. Burdick (Sept. 23); A. A. Adams, J. A. B. Begg, G. R. Canavan, A. L. Christian, W. I. Clarke, A. E. Clouston, J. A. Dobson, J. N. Dufort, J. A. C. Forbes, E. Foster, W. M. Hargreaves, W. H. Husbands, J. J. Murphy, L. J. Neale, F. R. Newell, R. A. Phillips, H. Pilling, D. G. Singleton, F. G. L. Smith, J. G. Younghusband (Oct. 10). Pilot Officer on probation J. C. W. Staveley is confirmed in rank and promoted to the rank of Flying Officer (Oct. 1); Lt. T. H. Villiers, R.N., Flying Officer, R.A.F., relinquishes his temp. commn. on retirement from Royal Navy (Oct. 1).

*Stores Branch*

Flight Lieut. H. J. Barnham is placed on retired list (Oct. 15).

*Chaplains Branch*

The Rev. T. M. Jones, B.A., is granted a short service commn. as Chaplain (Presbyterian) with relative rank of Squadron Leader (Oct. 10).

### RESERVE OF AIR FORCE OFFICERS

*General Duties Branch*

Pilot Officer on probation C. Watson is confirmed in rank (Oct. 15); Flying Officer J. F. Lawn is transferred from Class A to Class C (Oct. 2); Pilot Officer on probation R. C. Reynell relinquishes his commn. on appointment to a short service commn. in R.A.F. (Sept. 28).

*Stores Branch*

Flying Officer H. J. Thomas relinquishes his commn. on completion of service and is permitted to retain his rank (June 17).

*Erratum*

*Gazette* Sept. 29 (FLIGHT, Oct. 9, 1931, p. 1029)—*For* Flying Officer R. Y. Bush *read* Flight Lt. R. Y. Bush.

### SPECIAL RESERVE

*General Duties Branch*

Flight Lt. R. H. Maw relinquishes his commn. on appointment to short service commn. in R.A.F. (Oct. 1); Flying Officer N. A. Lindley resigns his commn. (May 5).

## ROYAL AIR FORCE INTELLIGENCE

*Stores Branch*

*Squadron-Leader* H. S. F. T. Jerrard, to Central Supply Depot, Hinaidi, Iraq, 26.9.31. *Flight-Lieutenant* F. B. Ludlow, O.B.E., M.C., to No. 4. Stores Depot, Ruislip, 4.10.31. *Flying Officers:* A. W. Rule, to H.Q., R.A.F., Middle East, Cairo, 26.9.31. R. E. P. Paynter, D.C.M., to R.A.F. Depot, Aboukir, Egypt, 26.9.31.

*Squadron Leader* W. A. Kingston, to H.Q., R.A.F., Mediterranean, Malta, 30.9.31.

*Flight Lieutenants:* F. E. Shorsby, to Station H.Q., Mount Batten, 6.10.31. G. J. Maygothling, to Station H.Q., Mount Batten, 9.10.31. H. J. Young, to Central Flying School, Wittering, 5.10.31.

*Flying Officers:* W. A. D. Collingwood, to No. 2 Stores (Ammunition) Depot, Altrincham, 5.10.31. R. B. Hortsmann, to No. 602 Sqdn., Glasgow, 5.10.31.

*Pilot Officer* J. R. Fraser, to R.A.F. M.T. Depot, Shrewsbury, 25.9.31.

## AIR MINISTRY NOTICES

### AIR MINISTRY NOTICES TO AIRMEN, SERIES A

**No. 62 of the year 1931. High Tension Cables near Private Landing Ground at Stallions Green, Tonbridge. (136531/31.)**

High tension cables are in course of erection in the immediate vicinity of the private landing ground at Stallions Green, near Hadlow (3½ miles N.E. of Tonbridge, Kent).

Pilots of aircraft are accordingly warned that the existence of these cables may render the use of this landing ground unsafe when the wind is blowing from certain directions. *October* 5, 1931.

**No. 63 of the year 1931. Night Flying without Navigation Lights. (84095/31.)**

Royal Air Force aircraft will be flying between 1900 and 0045 G.M.T. daily during the period from November 1 to December 31, 1931, over the area bounded by straight lines joining Chelsfield, Addington, Oxted, Sevenoaks and Chelsfield. Above an altitude of 5,000 ft. the aircraft will not exhibit navigation lights, unless other aircraft are observed in their vicinity. *October* 21, 1931.

### AIR MINISTRY NOTICES TO GROUND ENGINEERS

**No. 59 of the year 1931. Emergency Exit Requirements. (135849/31.)**

Provision must be made on all aeroplanes for the egress of passengers and crew in emergency.

Aeroplanes classified as belonging to Sub-division (*a*)—Public transport of passengers—must be provided with means of exit from every passenger compartment (doors, windows, ripping panels, etc.) at the rate of at least one exit for every four passenger seats. Included in these must be exits in the top of every passenger compartment at the rate of at least one for every eight passenger seats.

Windows counted as emergency exits must be easy to open or push out, and must be equally divided between the two sides of the aeroplane. If elliptic or rectangular, the principal internal dimensions must not be less than 18 in. by 12 in. If round or square, the diameter or length of side must be at least 18 in.

Outer doors must open outwards and in such a way that the pressure of the relative wind tends to keep them closed.

Suitable emergency exits must be provided for members of the crew isolated from passenger compartments.

The position of emergency exits must be clearly indicated.

It is proposed in due course to incorporate the above requirements as a Design Leaflet in Air Publication 1208, Airworthiness Handbook for Civil Aircraft. *September* 26, 1931.

### THE ROYAL AIR FORCE MEMORIAL FUND

THE fourth meeting of the Executive Committee of the Fund was held at Iddesleigh House, Caxton Street, London, S.W.1, on Wednesday, October 7, 1931. Sir Charles McLeod was in the chair, and there was a very full attendance of members.

Two resignations of old members were reported to the Committee, namely, Air Vice-Marshal T. I. Webb-Bowen, C.B., who was leaving town to take over command at Andover, and Air Vice-Marshal Sir C. L. Lambe, K.C.B., lately commanding Coastal Area, R.A.F., and who is retiring from the Service. In their places Air Marshal Sir Geoffrey Salmond, K.C.B., and Air Vice-Marshal R. H. Clark-Hall, C.M.G., have been invited to join the Executive Committee.

The Committee were informed that since the last meeting, held on July 1, 1931, the Grants Sub-Committee and the secretary have dealt with 305 cases of appeals for help, and that the sum of £2,583 1*s*. 4*d*. had been disbursed in grants to all ranks, past and present.

It was announced to the meeting that the Grants Committee had made a donation from the Fund of £10 10*s*. to the Royal United Service Orphans' Home for Girls, Devonport, in respect to five children of two ex-airmen who are now being maintained in that Home.

The Committee were informed that Vanbrugh Castle School, Blackheath, maintained by the Fund, had opened for the Christmas term on September 8 with 38 boys.

The attention of the Committee was drawn to the fact that the Armistice celebration, so far as concerns the R.A.F. War Memorial on the Victoria Embankment, would take place at 12 noon on Sunday, November 8 next, when Air Chief Marshal Sir John Salmond, G.C.B., Chief of the Air Staff, would lay a wreath at the foot of the memorial. A sum of £10 was ordered by the Committee to be expended for provision of the wreath selected, and a sum of £5 was sanctioned for the provision of a wreath to be laid at the foot of the Scottish National War Memorial (R.A.F. Bay), Edinburgh.

The usual meeting of the Grants Sub-Committee of the Fund was held on October 2. Mr. W. S. Field was in the chair, and the other members of the Committee present were: Mrs. L. M. K. Pratt Barlow, O.B.E.; Air Commodore B. C. H. Drew, C.M.G.; Sqd. Ldr. A. H. Wann. The Committee considered in all nine cases, and made grants to the amount of £197 1*s*. 3*d*.

At the meeting held on October 15, Mr. W. S. Field was in the chair, and the other members of the Committee present were: Mrs. L. M. K. Pratt Barlow, Air Commodore B. C. H. Drew, Mrs. F. Vesey Holt, Sqd. Ldr. A. H. Wann. The Committee considered in all eight cases, and made grants to the amount of £148 2*s*. 11*d*.

**R.A.F. Aircraft Apprentices**

THE Air Ministry announces:—

In view of the urgent need for national economy, it is regretted that a considerable reduction must be made in the number of boys to be enlisted into the Royal Air Force in January next, for training as aircraft apprentices. The number to be taken has now been fixed at 180.

**New Bomber Squadrons**

No. 18 (Bomber) Squadron was formed at Upper Heyford on October 20, 1931, in accordance with Establishment No. HD/XC, dated October 20, 1931. This establishment will be cancelled when a revised establishment for Upper Heyford is issued.

No. 57 (Bomber) Squadron was formed at Netheravon on October 20, 1931, in accordance with Establishment No. HD./23, dated October 20, 1931. This establishment will be cancelled when a revised establishment for Netheravon is issued. No. 57 Squadron will come under the A.O.C., Inland Area, for administration, and under the A.O.C., Wessex Bombing Area, for operations and training.

**Long Service and Good Conduct Medal**

THE Long Service and Good Conduct medal has been awarded to the undermentioned airmen:—

Sgt. Majs. W. Dalton, S. H. Graham, J. Greener, E. D. Jackson, C. Maynard, F. J. Smith, G. F. Paice.

Flt. Sgts. J. S. Brett, W. A. C. Elsby, G. W. Hepple, R. Hollingworth, W. McCarthy, H. P. Simpson, M.M., A.F.M., F. Warwick.

Sgts. W. E. Elliott, H. E. Laidler, F. W. Middleditch, A. Peters.

**Change in Royal Air Force Higher Command**

THE Air Ministry announces the following appointment:—Air Commodore Cuthbert Trelawder Maclean, D.S.O., M.C., formerly Officer Commanding British Forces in Aden, to be Director of Postings at the Air Ministry, with effect from December 21, 1931, vice Group Captain Francis Knox Haskins, D.S.C., A.D.C.

Air Commodore C. T. Maclean entered the Army in 1914, as Second Lieutenant, Royal Fusiliers, and joined the Royal Flying Corps in December, 1915. During the Great War he served in France with the Royal Flying Corps and the Royal Air Force and, in addition to receiving the awards of D.S.O. and M.C., was mentioned in despatches on three occasions. He was appointed to a permanent commission in the Royal Air Force in 1919 and later commanded a Flying Training School at home and units in Iraq and Egypt. He became Officer Commanding, British Forces in Aden in September, 1929, and was promoted to the rank of Air Commodore in July, 1931.

**H.M.S. Engadine Re-Union**

The Annual Re-Union of the officers and men of H.M.S. *Engadine* will be held at the Adelphi Hotel, John Street, Strand, on Saturday, November 14, at 6 p.m. Particulars from Arthur B. Ward, 135, Burbage Road, Dulwich, S.E. 21.

# AIRCRAFT COMPANIES' STOCKS AND SHARES

SENTIMENT in the market for industrial shares has been buoyant during the past month under the influence of General Election considerations and the City's belief that before long a tariff policy will be adopted. On balance for the month many leading industrial shares show a substantial rise despite the fact that towards the end of the month profit taking was in evidence. Generally speaking, fixed interest bearing issues and preference shares have gone out of favour, and were marked down at one time, but there has since been a noticeable tendency towards recovery. The fact that the shares of many companies associated with the aircraft industry have shown good response to the general marking up of values has been taken to indicate that these companies stand to benefit if a tariff policy is adopted. The report of Imperial Airways with the decline in net profits from £60,139 to £27,140 and the "cut" in the dividend from 5 to 3 per cent. has attracted attention to the company's shares. It is not, therefore, without significance that although now quoted "ex," the dividend, they are 1s. higher than a month ago; it has been generally recognised that the directors have again dealt with the accounts and profits in a conservative manner and that the African extension and, of course, general improvement in world trade conditions should enable the company quickly to re-establish its earning capacity. Fairey Aviation have come in for a good deal of support on the expectation that the report, due in December, will show a good expansion in profits; there are hopes of an increase in the dividend, but no doubt the directors will be largely influenced in their decision by the indications over the next few weeks of the general trade outlook. D. Napier & Son show little change on balance, the lower price having brought in buyers; at the time of writing the report is current that the company has been successful in obtaining control of Bentley Motors. De Havilland have had a rise of several shillings on the month; in this case market men are not so far inclined to discuss the dividend for the year ended last month. Handley Page have not quite held all their improvement of the previous month. National Flying Services have changed hands at around 3d., pending the issue of the report. There has been a sustained demand for Vickers shares on trade and tariff hopes; the yield is now on the small side at around 5¼ per cent. Rolls-Royce reflected the general tendency, aided by the motor show. A number of interesting reports have been published, but they have had little influence on quotations in most cases. Serck Radiators were only a shade lower at Birmingham, the profits of £20,505, against £26,495, and the dividend of 15 per cent. as against 17½ per cent. being considered very satisfactory. British Piston Ring moved against holders on the dividend "out" from 22½ to 10 per cent. The decline in Kayser Ellison's profits from £36,969 to £15,975 and the absence of a dividend has not led to dealings in the company's shares. Joseph Lucas, which show a good rise on balance for the month, were marked up sharply on the past year's very satisfactory results, which permit of a distribution of 20 per cent., against 25 per cent. Triplex Safety Glass have also risen substantially following the publication of the report and the meeting; there is no doubt that the company is now in a supreme position in the safety glass industry, and the satisfactory financial position augurs well for the future. British Aluminium have been a rising market on the hope that the international agreement among producers will lead to a rise in the price of the metal. Thanks to the buoyancy of markets, Dunlop Rubber have now made a good recovery from the low price to which they fell on the passing of the interim dividend. "Shell" have had a good rise in common with other leading oil shares, aided by the Anglo-Persian-Royal Dutch-Shell scheme for effecting distribution economies in the United Kingdom. The market is prepared for a big "cut" in the forthcoming "Shell" interim dividend.

| Name. | Class. | Nominal Amount of Share. | Last Annual Dividend. % | Current Week's Quotation. |
|---|---|---|---|---|
| Anglo-American Oil .. .. | Deb. | Stk. | 5½ | 97½ |
| Armstrong Siddeley Develop .. | Cum. Pref. | £1 | 6½ | 14/4½ |
| Birmingham Aluminium Castg. | Ord. | £1 | 7½ | 17/6 |
| Booth (James), 1915 .. .. | Ord. | £1 | 15 | 38/6 |
| Do. do. .. .. | Cum. Pref. | £1 | 7 | 20/– |
| British Aluminium .. .. | Ord. | £1 | 10 | 32/6 |
| Do. do. .. .. | Cum. Pref. | £1 | 6 | 16/10½ |
| British Celanese .. .. | Ord. | 10/– | Nil | 4/– |
| British Oxygen .. .. | Ord. | £1 | 8B | 16/10½ |
| Do. do. .. .. | Cum. Pref. | £1 | 6½ | 18/9 |
| British Piston Ring .. .. | Ord. | £1 | 10 | 25/– |
| British Thomson-Houston .. | Cum. Pref | £1 | 7 | 21/6 |
| Brown Brothers .. .. | Ord. | £1 | 10 | 22/6 |
| Do. do. .. .. | Cum. Pref. | £1 | 7½ | 20/– |
| Dick (W. B.) .. .. .. | Cum. Pref. | £10 | 5 | 116/3 |
| De Havilland Aircraft .. | Ord. | £1 | 5 | 16/3 |
| Dunlop Rubber .. .. | Ord. | c | 6 | 19/– |
| Do. do. .. .. | "C" Cum. Pref. | 16/– | 10 | 15/– |
| En-Tout-Cas (Syston) .. .. | Def. Ord. | 1/– | Nil | 1/– |
| Do. do. .. .. | Ptg. Pfd. Ord. | 5/– | 8 | 3/1½ |
| Fairey Aviation .. .. | Ord. | 10/– | 7* | 14/6 |
| Do. do. .. .. | 1st. Mt. Deb. | Stk. | 8 | 106 |
| Firth (T.) & John Brown .. | Cum. Pref. | £1 | 6D | 8/6 |
| Do. do. .. | Cum. Pref. | £1 | 5*D | 8/6 |
| Ford Motor (England) .. | Ord. | £1 | 10 | 38/1½ |
| Fox (Samuel) .. .. .. | Mt. Ptual. Deb. | Stk. | 5 | 72½ |
| Goodyear Tyre & Rubber .. | Deb. | Stk. | 6½ | 99½ |
| Handley Page .. .. .. | Ptg. Pref. | 8/– | 12½ | 10/7½ |
| Hoffmann Manufacturing .. | Ord. | £1 | Nil | 16/3 |
| Do. do. .. | Cum. Pref. | £1 | 7½ | 15/– |
| Imperial Airways .. .. | Ord. | £1 | 3 | 13/6 xd. |
| Kayser, Ellison .. .. | Ord. | £5 | Nil | 50/– |
| Do. do. .. .. | Cum. Pref. | £5 | 6 | 73/9 |
| Lucas (Joseph) .. .. | Ord. | £1 | 20 | 63/9 |
| Napier (D.), & Son .. .. | Ord. | 5/– | 15 | 5/3 |
| Do. do. .. .. | Cum. Pref. | £1 | 7½ | 20/– |
| Do. do. .. .. | Pref. | £1 | 8 | 17/6 |
| National Flying Services .. | Ord. | 2/– | Nil | –/4½ |
| Petters .. .. .. .. | Ord. | £1 | 6 | 20/– |
| Do. .. .. .. | Cum. Pref. | £1 | 7½ | 18/9 |
| Roe (A. V.) (Cont. by Armstrong Siddeley Devel., *q.v.*) | Ord. | £1 | — | — |
| Rolls-Royce .. .. .. | Ord. | £1 | 10 | 34/4½ |
| Smith (S.) & Sons (M.A.) .. | Def. Ord. | 1/– | 18¾ | 1/– |
| Do. do. .. | Ptg. Pfd. Ord. | £1 | 12¼ | 13/9 |
| Do. do. .. | Cum. Pref. | £1 | 7½ | 10/– |
| Serck Radiators .. .. | Ord. | £1 | 15 | 31/– |
| "Shell" Transport & Trading | Ord. | £1 | 17½* | 44/4½ |
| Do. do. .. .. | Cum. Pref. | £10 | 5 | £8¾ |
| Triplex Safety Glass .. .. | Ord. | £1 | 10 | 32/6 xd. |
| Vickers .. .. .. .. | Ord. | 6/8 | 8 | 10/– |
| Do. .. .. .. | Cum. Pref. | £1 | 5* | 17/9 |
| Vickers Aviation (Cont. by Vickers, *q.v.*) .. .. | — | — | — | — |
| Westland Aircraft (Branch of Petters, *q.v.*) .. .. .. | — | — | — | — |
| Whitehall Electric Investmts. | Cum. Pref. | £1 | 7½ | 21/6 |

*Dividend paid tax free.
c £1 unit of stock.
B Rate per annum for nine months.
D Last xd. on March 19.

## PUBLICATIONS RECEIVED

*Aeronautical Research Committee Reports and Memoranda: No.* 1374 (*E.46-I.C.E.* 789). *Oxidation Characteristics of Fuel Vapours with Regard to Engine Detonation.* By E. Mardles. November, 1930. Price 1s. 6d. net. London: H.M. Stationery Office, W.C.2.

*A Register of Civilian Aircraft.* Compiled by W. O. Manning and R. L. Preston. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net.

## AERONAUTICAL PATENT SPECIFICATIONS

*Abbreviations:* Cyl. = cylinder; i.c. = internal combustion; m. = motors
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### APPLIED FOR IN 1930

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